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GMAT MATH

Percent

1

- What is the percent formula?
- How much is 15 percent of 20?



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MATH: ARITHMETIC

Percent 2

3

- What is the formula for percent change?
- If Jack got a raise from \$15 per hour to \$18 per hour, what was the percent increase?



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MATH: ARITHMETIC

Percent | Answers

2

- Percent Formula:
Part = Percent x Whole

- For example, 15% of 20 is:

$$\frac{15}{100} * 20 = \frac{300}{100} = 3$$



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MATH: ARITHMETIC

Percent 2 | Answers

4

- Percent Change Formula:

$$\frac{\text{amount of change}}{\text{original amount}} \times 100\%$$

- Jack's Raise:

$$\frac{18 - 15}{15} \times 100\% = \frac{3}{15} \times 100\% = \frac{100}{5} = 20\%$$

- ! Make sure you use the original amount (15), not the new one (18)



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MATH: ARITHMETIC

Percent 3

5

- If the production of hybrid cars tripled last year, by how many percent did it increase?
 - 100%
 - 200%
 - 250%
 - 300%
 - 333%



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MATH: ARITHMETIC

Percent 4

7

- 50% of 25 is 25% of which number?



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MATH: ARITHMETIC

Percent 3 | Answers

6

- **The correct answer is B – increased by 200%**
- For example, if production was 10 cars, and it tripled to 30 cars, the increase was 20 cars, which is 200% of 10



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MATH: ARITHMETIC

Percent 4 | Answers

8

- There are 2 solutions to this problem:
- Long one:
 - 50% of 25 is 12.5
 - $12.5 * 100 = x * 25$
 - $x = 50$
- Short one but a harder to come up with:
 - $50\% * 25 = x * 25\%$
 - $50 = x$



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MATH: ARITHMETIC

Odd/Even Rules

9

Check your knowledge of Odd/Even rules

- ☐ Odd + Odd = ?
- ☐ Odd – Even = ?
- ☐ Even + Odd = ?
- ☐ Odd x Odd = ?
- ☐ Odd ÷ Even = ?
- ☐ Odd x Even = ?

Hint: try picking numbers



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MATH: ARITHMETIC

Odd/Even Rules 2

11

- ☐ Is 0 odd or even?



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MATH: ARITHMETIC

Odd/Even Rules | Answers

10

- ☐ Odd + Odd = $1 + 1 = 2$ (Even)
- ☐ Odd – Even = $3 - 2 = 1$ (Odd)
- ☐ Even + Odd = $2 + 1 = 3$ (Odd)
- ☐ Odd x Odd = $3 \times 3 = 9$ (Odd)
- ☐ Odd ÷ Even = $3 \div 2 = 1.5$ (Not an integer!)
- ☐ Odd x Even = $3 \times 2 = 6$ (Even)



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Odd/Even Rules 2 | Answers

12

- ☐ 0 (zero) is Even
- ☐ It is also not positive or negative
– it is neutral



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MATH: ARITHMETIC

Odd/Even Rules 3

13

- If b is an odd number, which of the following must be even?

A. $2b - 3$

B. $\frac{b-1}{2}$

C. $\frac{b}{2} - 1$

D. $b^2 + 2$

E. $2b + 2$



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MATH: ARITHMETIC

Odd/Even Rules 4 (Ultra Hard)

15

- Is $A+B+C$ even or odd?

□ $A - C - B$ is even

□ $\frac{A-C}{B}$ is odd



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MATH: ARITHMETIC

Odd/Even Rules 3 | Answers

14

- Use the “plug numbers” method to check each answer choice. Let's take 1:

A. $2*1 - 3 = -1$ (Odd)

B. $\frac{1-1}{2} = 0$ (Even) – however, just in case, let's try 3.
 $\frac{3-1}{2} = 1$ (Odd). It usually is a good idea to run through 2 different numbers if you get zero or similar

C. $\frac{1}{2} - 1 = -\frac{1}{2}$ (not an integer)

D. $1 + 2 = 3$ (Odd)

E. $2 + 2 = 4$ (Even)



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MATH: ARITHMETIC

Odd/Even Rules 4 | Answers

16

- Statements (1) and (2) combined are insufficient. Consider $A=6$, $B=4$, and $C=2$ (the answer is "yes") and $A=0.5$, $B=0.3$, and $C=0.2$ (the answer is "no").
- Do not assume that the numbers are integers if the question does not mention it.
- The correct answer is E.



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MATH: ARITHMETIC

Divisibility Rules

17

- Is 54780 divisible by 2?
- Is 1671 divisible by 3?
- Is 5632 divisible by 4?
- Is 3830 divisible by 5?
- Is 2658 divisible by 6?
- Is 396 divisible by 9?



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MATH: ARITHMETIC

Divisibility 2 (Hard)

19

- Is integer x^2y^4 divisible by 9?
 - ▣ x is an integer divisible by 3
 - ▣ xy is an integer divisible by 9



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MATH: ARITHMETIC

Divisibility Rules | Answers

18

- Yes. Divisibility by 2 – last digit of a number is even
- Yes. Divisibility by 3 – sum of all digits is a multiple of 3
- Yes. Divisibility by 4 – last 2 digits is a multiple of 4
- Yes. Divisibility by 5 – the last digit is either 0 or 5
- Yes. Divisibility by 6 – the sum of digits is a multiple of 3 and the last digit is even
- Yes. Divisibility by 9 – the sum of digits is a multiple of 9



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MATH: ARITHMETIC

Divisibility 2 | Answers

20

- The best way to approach this question is to plug in several sets of numbers
- Many are tempted to plug 3 for x and then for S_2 , the only value y can have is 3; in that case, the answer is Yes.
- But if we try $x=81$ and $y=\frac{1}{9}$, then x is an integer divisible by 3, xy is an integer divisible by 9, but $x^2y^4 = 1$ and is not divisible by 9.
- **The answer is E**



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MATH: ARITHMETIC

Number Properties

21

- Which of the following integers represents a sum of 3 consecutive even integers?
 - ▣ 200
 - ▣ 303
 - ▣ 400
 - ▣ 554
 - ▣ 570



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MATH: ARITHMETIC

Number Properties 2 (Hard)

23

- If $x^2 = y + 5$, $y = z - 2$, and $z = 2x$, is $x^3 + y^2 + z$ divisible by 7?
 - ▣ $x > 0$
 - ▣ $y = 4$



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MATH: ARITHMETIC

Number Properties | Answers

22

- To answer the question, check which integer is both divisible by 3 (since there are 3 integers) and is even. The only number that falls into both of those 2 categories is 570.
- **Correct answer is E**



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Number Properties 2 | Answers

24

- Substitute x , y , and z in the original equation to get the following: $x^2 - 2x - 3 = 0$; The solutions to this equation are $x = -1$ and $x = 3$.
- Statement 1 is sufficient. If $x > 0$, then the only solution is $x = 3$. The result is $27 + 16 + 6 = 49$, which is divisible by 7
- Statement 2 is sufficient. If $y = 4$, plugging in this value into $x^2 = y + 5$, gives us that $x = 3$ or $x = -3$. However, based on the above, $x = 3$ or $x = -1$. Therefore $x = 3$. Sufficient.
- **The correct answer is D.**



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MATH: ARITHMETIC

Number Properties 3

25

- How many distinct integers are there between 1 and 21 inclusive?



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MATH: ARITHMETIC

Multiples

27

- What is a multiple?
- Is 5 a multiple of 55 or is 55 a multiple of 5?



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Number Properties 3 | Answers

26

- Most often GMAT questions will say “inclusive” but sometimes they don’t – need to remember to check
- The formula for calculating the number of integers between two numbers is: $N - M + 1$
- Therefore, the answer is: $21 - 1 + 1 = 21$
- You can also write out all of the numbers though it is not always possible but just in case:
- 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21



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MATH: ARITHMETIC

Multiples | Answers

28

- **The multiple** of a number is the product of the number and any other whole number. *(For example, 2, 4, 6, 8 are multiples of 2)*
- Therefore 55 is a multiple of 5
- For example, 6 has factors 1, 2, 3, 6; and multiples that are 6, 12, 24, 36...



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Multiples 2

29

- Is 0 (zero) a multiple of 100?



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Multiples 3

31

- How to find a Least Common Multiple (LCM)?



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Multiples 2 | Answers

30

- Yes, 0 (zero) is a multiple of everything
- *However, it is unlikely that GMAT will test this property but it helps to remember*



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MATH: ARITHMETIC

Multiples 3 | Answers

32

- **Option 1:**
 - Step 1: Find the prime factors of each of the numbers
 - Step 2: Multiply the unique factors (exclude duplicates)
- **Option 2:**
 - Step 1: Multiply the two numbers
 - Step 2: Find any factors the two numbers share
 - Step 3: Divide the product in Step 1 by the factors that the two numbers have in common



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MATH: ARITHMETIC

Multiples 4

33

- What is the Least Common Multiple of 18 and 24?



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MATH: ARITHMETIC

Translate

35

- The product of three and four is reduced by five and then increased by the difference between the original product and eight = ?



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MATH: ARITHMETIC

Multiples 2 Answers

34

- **Option 1**
 - Find the factors of 18 and 24:
 $18 = 3 \times 3 \times 2$
 $24 = 3 \times 2 \times 2 \times 2$
 - Multiply the unique factors: $3 \times 3 \times 2 \times 2 \times 2 = 72$
- **Option 2**
 - Multiply the 2 numbers: $18 \times 24 = 432$
 - Shared factors: 2 and 3
 - Divide 432 by 2 and 3 = 72



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MATH: ARITHMETIC

Translate Answers

36

- $3 \times 4 = 12$
- $12 - 5 = 7$
- $12 - 8 = 4$
- $7 + 4 = 11$
- **Answer: 11**



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MATH: ARITHMETIC

Arithmetic to Memorize

37

- $\square \frac{1}{2} =$
- $\square \frac{1}{4} =$
- $\square \frac{2}{5} =$
- $\square \frac{1}{20} =$
- $\square \frac{1}{8} =$
- $\square \frac{1}{6} =$



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MATH: ARITHMETIC

Arithmetic to Memorize 2

39

- $\square \frac{1}{12} =$
- $\square \frac{7}{8} =$
- $\square \frac{3}{4} =$
- $\square 75\% =$
- $\square 20\% =$
- $\square 16\frac{2}{3}\% =$
- $\square 83\frac{1}{3}\% =$



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MATH: ARITHMETIC

Arithmetic to Memorize | Answers

38

- $\square \frac{1}{2} = 50\%$
- $\square \frac{1}{4} = 25\%$
- $\square \frac{2}{5} = 40\%$
- $\square \frac{1}{20} = 5\%$
- $\square \frac{1}{8} = 12.5\%$
- $\square \frac{1}{6} = 16.67\%$



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MATH: ARITHMETIC

Arithmetic to Memorize 2 | Answers

40

- $\square \frac{1}{12} = 8.33\%$
- $\square \frac{7}{8} = 87.5\%$
- $\square \frac{3}{4} = 75\%$
- $\square 75\% = \frac{3}{4}$
- $\square 20\% = \frac{1}{5}$
- $\square 16\frac{2}{3}\% = \frac{1}{6}$
- $\square 83\frac{1}{3}\% = \frac{5}{6}$



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MATH: ARITHMETIC

Arithmetic to Memorize 3

41

- $2^2 =$
- $2^3 =$
- $2^4 =$
- $2^5 =$
- $2^6 =$
- $2^7 =$



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MATH: ARITHMETIC

Arithmetic to Memorize 4

43

- $3^2 =$
- $3^3 =$
- $3^4 =$
- $3^5 =$
- $4^2 =$
- $4^3 =$
- $4^4 =$



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MATH: ARITHMETIC

Arithmetic to Memorize 3 | Answers

42

- $2^2 = 4$
- $2^3 = 8$
- $2^4 = 16$
- $2^5 = 32$
- $2^6 = 64$
- $2^7 = 128$



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MATH: ARITHMETIC

Arithmetic to Memorize 4 | Answers

44

- $3^2 = 9$
- $3^3 = 27$
- $3^4 = 81$
- $3^5 = 243$
- $4^2 = 16$
- $4^3 = 64$
- $4^4 = 256$



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MATH: ARITHMETIC

Arithmetic to Memorize 5

45

- $5^2 =$
- $5^3 =$
- $11^2 =$
- $12^2 =$
- $13^2 =$
- $14^2 =$
- $15^2 =$
- $16^2 =$



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Arithmetic to Memorize 6

47

□ Complete the following:

□ 8, 16, 24, 32, 40, 160

□ 12, 24, 36.... 120

□ 15, 30... 150



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MATH: ARITHMETIC

Arithmetic to Memorize 5 | Answers

46

- $5^2 = 25$
- $5^3 = 125$
- $11^2 = 121$
- $12^2 = 144$
- $13^2 = 169$
- $14^2 = 196$
- $15^2 = 225$
- $16^2 = 256$



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Arithmetic to Memorize 6 | Answers

48

□ Complete the following (Answers):

□ 8, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88, 96, 104, 112, 120

□ 12, 24, 36, 48, 60, 72, 84, 96, 108, 120

□ 15, 30, 45, 60, 75, 90, 105, 120



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MATH: ARITHMETIC

Arithmetic to Memorize 7

49

- $\sqrt{2} =$
- $\sqrt{3} =$
- $\sqrt{625} =$
- $\sqrt{169} =$
- List all Primes between 1 and 50
- **Extra Hard & Extra Credit**
 - $2^6 =$
 - $\sqrt[3]{125} =$
 - $\sqrt[5]{243} =$



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MATH: ARITHMETIC

Reciprocal

51

- What is a reciprocal?



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Arithmetic to Memorize 7 | Answers

50

- $\sqrt{2} = 1.4$
- $\sqrt{3} = 1.7$
- $\sqrt{625} = 25$
- $\sqrt{169} = 13$
- Primes: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47
 - $2^6 = 64$
 - $\sqrt[3]{125} = 5$
 - $\sqrt[5]{243} = 3$



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MATH: ARITHMETIC

Reciprocal Answers

52

- Reciprocal for a number x , denoted by $\frac{1}{x}$ or x^{-1} , is a number which when multiplied by x yields 1. The reciprocal of a fraction $\frac{a}{b}$ is $\frac{b}{a}$.
- For example reciprocal of 3 is $\frac{1}{3}$
- Reciprocal of $\frac{5}{6}$ is $\frac{6}{5}$.



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MATH: ARITHMETIC

Absolute Value

53

- What is the 3- step approach to solving equations and inequalities with absolute value?



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Absolute Value 2

55

- If $|x-1| = 4$, what is the value of x ?



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Absolute Value | Answers

54

- **Step1:** Open modulus and set conditions. To solve/open a modulus, you need to consider 2 situations to find all roots:
 - ▣ Positive (or rather non-negative)
 - ▣ Negative
- **Step 2:** Solve new equations from Step 1
- **Step 3:** Check conditions for each solution from Step 2



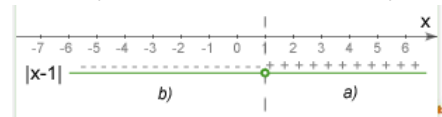
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Absolute Value 2 | Answers

56

- Step 1: Find positive/negative roots:
 - ▣ $x - 1 \geq 0$ in our case, $x - 1 = 4$
 - ▣ $x - 1 < 0$ in our case, $-(x - 1) = 4$
- Step 2: Solve the equations
 - ▣ $x = 5$
 - ▣ $x = -3$
- Step 3: Check conditions ($x - 1 \geq 0$ & $x - 1 < 0$)
 - ▣ $5 - 1 = 4 \geq 0$
 - ▣ $-3 - 1 = -4 < 0$



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Absolute Value 3

57

- What is the value of x if $|x - 5| = 10$?



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Absolute Value 4

59

- Is $M < 0$?
 - $-M = |M|$
 - $M^2 = 9$



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Absolute Value 3 | Answers

58

- $|x - 5| = 10$
- We must evaluate both the positive and negative outcome since the absolute value “removes” the negative sign
- Thus, we have 2 equations:
 - $x - 5 = 10$
 - $x - 5 = -10$ (in case it was a negative expression)
- Thus $x = 15$ and -5 . (Plug in both to check)
- Absolute value inequalities and equations will almost always have 2 answers/solutions!



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MATH: ARITHMETIC

Absolute Value 4 | Answers

60

- Statement (1) by itself is not sufficient. From statement (1), M is either a negative number or zero. If $M = -3$, then $-(-3) = |-3|$ or $3 = 3$, which is not sufficient.
- Statement (2) by itself is not sufficient. From statement (2), M can be either 3 or -3, which is not sufficient.
- Statements (1) and (2) combined are sufficient. If we combine both statements, then $M = -3$.
- **The correct answer is C.**



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MATH: ARITHMETIC

Factors

61

- How many total factors does 462 have?



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Factors 2

63

- Do integers usually have an odd or even number of factors?



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Factors | Answers

62

- Advanced method for finding the number of all possible factors:
 - Write out each prime factor and their power, for example, 12 can be written as follows:
 - 2^2
 - 3^1
 - 5^0 etc (all other primes will have a zero power)
 - Add 1 to all powers and multiply them: (in this case 6) and that's the number of factors (1, 2, 3, 4, 6, 12)
 - Prime Factors of 462 = $2^1, 3^1, 7^1, 11^1$
 - Total number of factors: $2 \times 2 \times 2 \times 2 = 2^4 = 16$



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MATH: ARITHMETIC

Factors 2 | Answers

64

- Vast majority of integers have an even number of factors such as 12 for example: 1, 2, 3, 4, 6, 12. Thus when finding the total number of factors, make sure it is an even number
- The only integers that have an odd number of factors are perfect squares (that's numbers such as 4, 9, 16, 25, 36, etc). Try 25 for example, it has factors of 1, 5, and 25. Factors of 36 are 1, 2, 3, 4, 6, 9, 12, 18, 36.



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MATH: ARITHMETIC

Ratios

65

- What is the ratio of a to d if $2a=3b$, $\frac{1}{2}b=2c$, and $3c=d$?

A) 1:2 B) 2:1 C) 2:3 D) 4:3 E) 1:5



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MATH: ARITHMETIC

Powers

67

- $2^2 + 2^3 + 2^4 + 2 = ?$
- A) $2^9 + 2$
B) 2^{10}
C) $2^5 + 2$
D) 2^5
E) 30



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MATH: ARITHMETIC

Ratios

66

- With questions like these, unless you can spot a shortcut right away, the easiest way to solve is to plug numbers: let's pick $a=6$, since there is a 2 and 3 involved
- $2*6 = 3b$; $b = 4$
- $0.5*4 = 2c$; $c = 1$
- $3*1 = d$; $d = 3$
- Therefore, the ratio of a to d is 2:1
- **The correct answer is B.**



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MATH: ARITHMETIC

Powers | Answers

68

- $2^2 + 2^3 + 2^4 + 2 = ?$
- There are no rules for adding or subtracting powers. This question is solved by brute force:
 $4 + 8 + 16 + 2 = 30$
- The correct answer is (E)



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MATH: ARITHMETIC

Powers 2

69

□ $2^2 \times 2^3 \times 2^4 \times 2^5 \times 2 = ?$

- A) 2^{120}
- B) 32^{15}
- C) 2^{15}
- D) 2^{14}
- E) 62



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MATH: ARITHMETIC

Powers 3

71

□ $\frac{2^4 \times 2^8}{2^6 \times 2} = ?$



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MATH: ARITHMETIC

Powers 2 | Answers

70

□ $2^2 \times 2^3 \times 2^4 \times 2^5 \times 2 = 2^{15}$

When powers with the same base (2 in this case) are multiplied, the powers are summed and the base is held constant. Thus, it is 2 to the power of $2+3+4+5+1=15$.

The correct answer is (C) 2^{15}



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MATH: ARITHMETIC

Powers 3 | Answers

72

□ $\frac{2^4 \times 2^8}{2^6 \times 2} = \frac{2^{12}}{2^7} = 2^5$

- Division of powers with the same base (2) is handled similarly to multiplication except the power values are deducted. The base stays unchanged



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MATH: ARITHMETIC

Powers 4

73

□ $(3^3)^2 = ?$



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MATH: ARITHMETIC

Powers 5

75

□ $3^{3^3} = ?$



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MATH: ARITHMETIC

Powers 4 | Answers

74

- $(3^3)^2 = 3^6$
- When a number taken to a power is taken to another power, you need to multiply the exponents ($2 * 3$)



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MATH: ARITHMETIC

Powers 5 | Answers

76

- $3^{3^3} = 3^{27}$
- Start operations from outside and work your way in: 3 taken to the power of 3 is 27. Thus the base of 3 is taken to the power of 27.



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MATH: ARITHMETIC

Powers 6

77

□ $2^{-2} \times 2^{-3} \times 2^6 \times 2^{-4} = ?$



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MATH: ARITHMETIC

Powers 7

79

□ $5^0 = ?$



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MATH: ARITHMETIC

Powers 6 | Answers

78

□ $2^{-2} \times 2^{-3} \times 2^6 \times 2^{-4} = 2^{-3} = \frac{1}{2^3} = \frac{1}{8}$

- Negative powers turn a number to a reciprocal number taken to that power.

For example $2^{-2} = \frac{1}{2^2} = \frac{1}{4}$



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MATH: ARITHMETIC

Powers 7 | Answers

80

□ $5^0 = 1$

- Any number (positive or negative) taken to the power of 0 (zero) equal to 1.

- Not tested on the GMAT, zero to the power of zero is also 1.



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MATH: ARITHMETIC

Powers 8

81

□ $4^{\frac{1}{2}} = ?$



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MATH: ARITHMETIC

Powers 9 (Ultra Hard)

83

- If m and n are positive integers, is the remainder of $\frac{10^{m+n}}{3}$ larger than the remainder of $\frac{10^{n+m}}{3}$?
- $m > n$
 - The remainder of $\frac{n}{3}$ is 2



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MATH: ARITHMETIC

Powers 8 | Answers

82

□ $4^{\frac{1}{2}} = \sqrt{4} = 2$

- Fraction powers are interpreted as follows: the denominator is the root and numerator is the power. For example $3^{\frac{2}{3}} = \sqrt[3]{3^2}$ or $2^{\frac{1}{2}} = \sqrt{2}$



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MATH: ARITHMETIC

Powers 9 | Answers

84

- Statement (1) by itself is insufficient. In expression $10^m + n$, the sum of digits of 10^m is always 1 and it is the value of n that determines the remainder of $\frac{10^{m+n}}{3}$. If you plug in $m=2, n=1$ (the answer is "yes") and $m=3, n=2$ (the answer is "no").
- Statement (2) by itself is sufficient. If the remainder of $\frac{n}{3}$ is 2, as S2 states, then is 2, 5, or 8 and the sum of the digits of $\frac{10^{m+n}}{3}$ is divisible by 3. Therefore, the remainder of $\frac{10^{m+n}}{3}$ is 0, which cannot be larger than the remainder of $\frac{10^{n+m}}{3}$ no matter what m is.
- **The correct answer is B.**



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MATH: ARITHMETIC

Percentiles

85

- Lena's first test score was at the 80th percentile in a class of 120 students. On another test, 24 out of 200 students scored better than Lena. If nobody had Lena's score, what is Lena's percentile after the two tests?



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MATH: ARITHMETIC

Consecutive Numbers

87

- What is the sum of consecutive integers -9, -8, -7, -6, -5, -4, -3, -2, -1, 0, 1, 2?



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MATH: ARITHMETIC

Percentiles | Answers

86

- Take each test result separately:
 - ▢ Test 1: $120 \times 80^{\text{th}} = 96$ (she scored better than 96 students)
 - ▢ Test 2: She scored better than 176 students ($200 - 24$)
- Sum up the results:
 - ▢ $96 + 176 = 272$
 - ▢ $120 + 200 = 320$
- $\frac{272}{320} = 85^{\text{th}}$ percentile



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MATH: ARITHMETIC

Consecutive Numbers | Answers

88

- Sum of consecutive integers equals the mean multiplied by the number of terms, n . Given consecutive integers -9, -8, -7, -6, -5, -4, -3, -2, -1, 0, 1, 2
 $mean = \frac{-9+2}{2} = -3.5$ (mean equals to the average of the first and last terms), so the sum equals to $-3.5 \times 12 = -42$.



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MATH: ARITHMETIC

Evenly Spaced Set

89

- What is the sum of all members of the set 9,12,15,18,21,24 ?



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MATH: ARITHMETIC

Recurring Decimal

91

- Express 0.393939... in a fraction format



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MATH: ARITHMETIC

Evenly Spaced Set | Answers

90

- The sum of elements of evenly spaced set is given by the formula
- $\text{Sum} = \frac{a_1 + a_n}{2} \times n$
- Therefore, $\frac{9+24}{2} \times 6 = 99$



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MATH: ARITHMETIC

Recurring Decimal | Answers

92

- **To convert a recurring decimal to fraction:**
 1. Separate the recurring number from the decimal fraction
 2. Annex denominator with "9" as many times as the length of the recurring number
 3. Reduce the fraction to its lowest terms

Example #1: Convert 0.3939... to a fraction

1: The recurring number is 39

2: $\frac{39}{99}$ - the number is 2 digits so two nines are added

3: Reducing it to lowest terms: $\frac{13}{33}$



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MATH: ARITHMETIC

Fractions (Extra Hard)

93

- If a , b , and c are positive distinct integers, is $\frac{\left(\frac{a}{b}\right)}{c}$ an integer?

- $c = 2$

- $a = b + c$



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MATH: ARITHMETIC

Fractions | Answers

94

- Statement I is insufficient since it does not provide enough information about b or c
- Statement II: We can rewrite $\frac{\left(\frac{a}{b}\right)}{c}$ as $\frac{a}{bc}$
- Now plug in the value for a from S2: $\frac{b+c}{bc} = \frac{1}{b} + \frac{1}{c}$
- since b and c are distinct positive integers and b is not equal to c , the expression cannot be an integer
- **The correct answer is B**



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MATH: ARITHMETIC

Algebra (Hard)

1

- If each expression under the square root is greater than or equal to 0, what is $\sqrt{x^2 - 6x + 9} + \sqrt{2 - x} + x - 3$?

- $\sqrt{2 - x}$
- $2x - 6 + \sqrt{2 - x}$
- $\sqrt{2 - x} + x - 3$
- $2x - 6 + \sqrt{x - 2}$
- $x + \sqrt{x - 2}$



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MATH: ALGEBRA

Algebra | Answers

2

- Based on the setup (and Math principles tested on the GMAT), $(2 - x)$ has to be ≥ 0 . Therefore $x \leq 2$.
- $\sqrt{x^2 - 6x + 9} = \sqrt{(x - 3)^2} = 3 - x$
- Because $x \leq 2$, $x - 3 < 0$
- Therefore: $3 - x + \sqrt{2 - x} + x - 3 = \sqrt{2 - x}$
- **The correct answer is A**



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MATH: ALGEBRA

Average

1

- If the average of 5 consecutive integers is 12, what is the average of the even only integers?
 - ▣ 10
 - ▣ 12
 - ▣ 13.5
 - ▣ 18
 - ▣ 36



Average 2

3

- For the past K days, the average (arithmetic mean) number of cupcakes baked by Liv was 55 per day. Today John helped Liv and together they baked 100 cupcakes, which raised the average to 60 cupcakes per day. What is the value of K?
 - ▣ A)8 B)9 C)10 D)12 E)13



Average | Answers

2

- First, find the consecutive integers. Since there are 5, there may be either 2 or 3 even integers. These integers are 10, 11, **12**, 13, 14. The average of the even integers is 12 as well ($10+12+14 = 36$. Divide 36 by 3 and you will get 12).
- **The correct answer is B.**



Average 2 | Answers

4

- The total number of cupcakes baked in K days was $55K$, which means that the total number of cupcakes baked in $K+1$ days was $55K+100$. Thus
$$\frac{55K+100}{K+1} = 60$$
K = 8. Answer is A
- Another, easier option is to backsolve – plug in answer choices. E.g. Take “C” – 10. That gives us: $550 \text{ cupcakes} + 100 = 650$. 650 divided by 60 is not 11. Try “A”. $440 + 100 = 540$. 540 divided by 60 is 9. We need it to be 9 ($8+1$) due to adding a day.



Mean

5

- How to find the Mean?



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MATH: STATISTICS

Median

7

- How to find the Median?



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MATH: STATISTICS

Mean

6

- Arithmetic Mean = Average =
$$\frac{\text{Sum of elements}}{\text{number of elements}}$$



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MATH: STATISTICS

Median | Answers

8

- Arrange all numbers in an order from the smallest to the largest. **The Median** will be the middle number. If there is an even number of elements, **the Median** will be the average of the 2 middle numbers



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MATH: STATISTICS

Mode

9

- How to find the mode?



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MATH: STATISTICS

Range

11

- How to find the Range?



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MATH: STATISTICS

Mode | Answers

10

- The Mode of an array is the number that appears most often. For example, in an array 1,2,3,3,4 – **the Mode** is 3. It appeared twice. In the array 1,2,3,3,4,4 – **the Mode** is 3 and 4 (there can be more than one mode).



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MATH: STATISTICS

Range | Answers

12

- **Range** is the difference between the smallest and largest elements of an array. If you have to find more than just range, it is always a good idea to rewrite the elements in an increasing order



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MATH: STATISTICS

Standard Deviation

13

- How to find the Standard Deviation?



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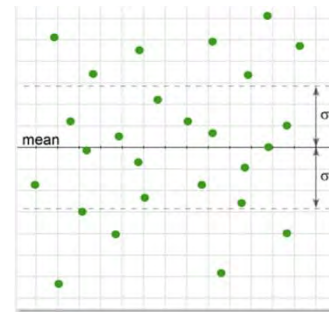
MATH: STATISTICS

Standard Deviation 2

15

- Which of the sets has a higher standard deviation?

Set A



Set B



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MATH: STATISTICS

Standard Deviation | Answers

14

- You won't have to calculate SD on the GMAT but you need to understand the concept of SD
- Standard Deviation measures how spread out the members of the array are. To find the Standard Deviation:
 - ▣ Find the mean
 - ▣ Find the difference between each number and the mean
 - ▣ Square each of the differences
 - ▣ Find the average of the squared differences
 - ▣ Take a square root of the average



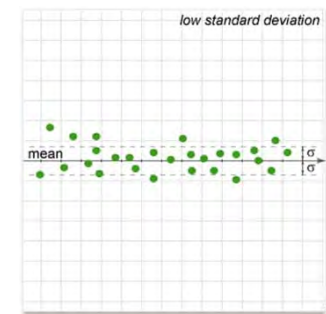
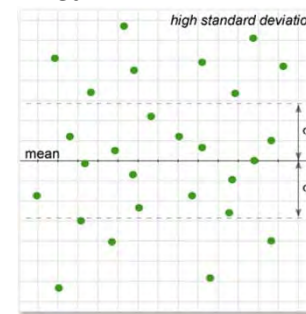
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MATH: STATISTICS

Standard Deviation 2 | Answers

16

- Set A has the higher Standard Deviation because the elements are distributed further from the mean



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MATH: STATISTICS

Standard Deviation 3

17

- What is the fastest way to estimate standard deviation (without calculating it)?
- There is a set {67,32,76,35,101,45,24,37}. If we create a new set that consists of all elements of the initial set but decreased by 17%, what is the change in standard deviation?



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MATH: STATISTICS

Standard Deviation 4

19

- What is the Standard Deviation of a set of consecutive even integers?
(1) There are 39 elements in the set.
(2) the mean of the set is 382



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MATH: STATISTICS

Standard Deviation 3 | Answers

18

- We don't need to calculate as decrease in all elements of a set by a constant percentage will decrease the standard deviation of the set by the same percentage (the average is decreased by 17% as well as the difference between average (mean) and all elements or their squares. Thus the decrease in standard deviation is 17%.
- You can always try to model a set of 3 numbers
- P.S. the 17% has been verified in Excel



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MATH: STATISTICS

Standard Deviation 4 | Answers

20

- Before reading Data Sufficiency statements, what can we say about the question? What should we know to find standard deviation? "consecutive even integers" means that all elements strictly related to each other. If we shift the set by adding or subtracting any integer, it does not change the standard deviation. One thing we should know is the number of elements in the set, because the more elements we have the broader they are distributed relative to the mean. Now, look at DS statements, all we need it is just first statement. So, A is sufficient.



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MATH: STATISTICS

Standard Deviation 5

21

- Set A consists of 19 integers with mean 4 and standard deviation of 3. If a new set B is formed by adding 2 more elements to the set A, what two elements will decrease the standard deviation the most?
 - A) 9 and 3
 - B) -3 and 3
 - C) 6 and 1
 - D) 4 and 5
 - E) 5 and 5



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MATH: STATISTICS

Standard Deviation 5 | Answers

22

- **Solution:** The closer to the mean, the smaller the standard deviation, and therefore, the greater the decrease in standard deviation. D has 4 (equal to the mean) and 5 (differs from mean only by 1).
- All other options have a greater deviation from the mean
- **Answer: D**



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MATH: STATISTICS

Compound Interest

1

- If \$20,000 is invested at 12% annual interest, compounded quarterly, what is the balance after 1 year?

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MATH: WORD PROBLEMS

Mixtures

3

- 14 liters of apple juice is mixed with cranberry juice. If the resulting mix contains 65% of cranberry juice, how many liters of the mix were produced?

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MATH: WORD PROBLEMS

Compound Interest | Answers

2

- Compound Interest formula:

$$= \text{principal} \times \left(1 + \frac{\text{Interest}}{C}\right)^{\text{years} \times C}$$

where **C** is the number of periods

- $20,000 \times \left(1 + \frac{0.12}{4}\right)^{1 \times 4} = 20,000 \times (1.03)^4$
- 1.03 to the 4th power is 1.1255
- Times 20,000, that's \$22,510
- (as opposed to 22,400 for simple interest)

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MATH: WORD PROBLEMS

Mixtures | Answers

4

- Mixture problems require attention to details to both the information given and the question.
- We know that the 14 liters of apple juice is 35% (100%-65%) of the new mixture.
- Construct an "X":
 - 14 liters-----35%
 - X liters -----100%
- $\frac{14 \times 100}{35} = 40$ liters

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MATH: WORD PROBLEMS

Work Problems

5

- What is the formula for a work problem?



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MATH: WORD PROBLEMS

Work Problems 2

7

- Robert working alone can unload a truck in 8 hours. Doug, on the other hand, can unload the same truck in 6 hours. If both are hired together, how much time will it take Robert and Doug to unload the truck working together?



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MATH: WORD PROBLEMS

Work Problems | Answers

6

- The key to solving the work problems, is setting the equation correctly. The work formula is based on the principle of work rates (inverse of the time it would take to complete the job). The rate almost always will be $\frac{1}{\text{time (of hours, days, etc)}}$
- Formula: Sum of the Rates of Workers = the combined rate
- $\frac{1}{W_1} + \frac{1}{W_2} = \frac{1}{C}$; where W is time required by workers 1 and 2 to complete the job and C is the time required for both workers working together (Combined)



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MATH: WORD PROBLEMS

Work Problems 2 | Answers

8

- Using the Work formula: $\frac{1}{R} + \frac{1}{D} = \frac{1}{C}$
- $\frac{1}{8} + \frac{1}{6} = \frac{1}{C}$
- $\frac{7}{24} = \frac{1}{C}$
- $C = \frac{24}{7} = 3.4 \text{ hours (approximately)}$



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MATH: WORD PROBLEMS

Group Problems

9

- Out of 90 conference attendees, 50 registered for the basic workshop and 60 signed up for the advanced workshop. If 20 attendees have not signed up for a workshop yet, how many signed up for both advanced and basic workshops?



Group Problems 2

11

- The office of 120 is split between male and female employees at the ratio of 3:5. If 40% of the employees are married and 20 of the married employees in the office are men, how many of the women working in the office are single?



Group Problems | Answers

10

- The best and easiest approach to solving this type of problems is using the both/neither formula (alternative option is a Venn diagram).
- $\text{Group1} + \text{Group2} + \text{Neither} - \text{Both} = \text{Total}$
- $50 + 60 + 20 - \text{Both} = 90$
- $130 - \text{Both} = 90$
- $\text{Both} = 40$
- The key is to memorize the formula and one sample question so you can plug in numbers on the test



Group Problems 2 | Answers

12

- To answer this question the fastest, we can put this table together:

	Male	Female	Total
Married	20	X	48
Single		75 - X	72
Total	45	75	120

- Thus $20 + X = 48$; $X = 28$. We can do the rest of the math and fill out the entire table to make sure your calculations are correct



Volume/Mixture Problems (Hard)

13

- If a farmer sells 15 of his chickens, his stock of feed will last for 4 more days than planned, but if he buys 20 more chickens, he will run out of feed 3 days earlier than planned. If no chickens are sold or bought, the farmer will be exactly on schedule. How many chickens does the farmer have?
- 12
- 24
- 48
- 55
- 60

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MATH: WORD PROBLEMS

Counting Problems (Ultra Hard)

15

- In a game of chess, the moves of whites and blacks alternate with whites having the first move. During a chess tournament, whites have made 2319 moves altogether while blacks have made 2315 moves. If in any game the side that made the last move did not lose, which of the following can be true about the tournament?
- I. Blacks lost 5 games
- II. Blacks won more games than whites
- III. All games ended in a draw

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MATH: WORD PROBLEMS

Volume/Mixture Problems | Answers

14

- Very hard problem. Several solutions exist; this one is probably not the most correct but the quickest:
- Let X be the number of chickens and Y be the days they can survive on the current feed:
- $(x-15)(y+4)=(x+20)(y-3)$
- ~~$xy + 4x - 15y - 60 = xy - 3x + 20y - 60$~~
- $4x - 15y = 20y - 3x$
- $7x = 35y$ or $x = 5y$
- Solving the first equation, we get $x=60$ and $y=12$

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MATH: WORD PROBLEMS

Counting Problems | Answers

16

- From the stem it follows that there were only 4 games in which whites had the last move. These 4 games were responsible for the difference in the total number of moves made by whites and blacks during the tournament. We know that these 4 games were not won by blacks (but they could well have ended in a draw). All the other games could have been won by blacks or ended in a draw. **Thus, scenarios II and III are possible.**
- Scenario I is impossible. It means that there were at least 5 games in which whites had the last move. If this were true then the difference between the total number of moves of whites and blacks should be at least 5. In fact, it's only 4.

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MATH: WORD PROBLEMS

Distance (Ultra Hard)

17

- A swimmer makes a round trip up and down the river which takes her X hours. If the next day she swims the same distance with the same speed in still water, which takes her Y hours, which of the following statements is true?
 - $X > Y$
 - $X < Y$
 - $X = Y$
 - $X = \frac{1}{2} \times Y$

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MATH: WORD PROBLEMS

Percent

19

- If a price was increased by $x\%$ and then decreased by $y\%$, is the new price higher than the original?
 - $x > y$
 - $x = 1.2y$

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MATH: WORD PROBLEMS

Distance | Answers

18

- Pick numbers and then check them against the options. Take 12 km as the distance traveled up/down the river, and assume the swimmer's speed to be 4 km/h; the current being 2 km/h, which means 6 km/h down the river and 2 km/h up the river. Going upriver takes 2 hours, return journey takes 6, thus a total of 8 hours. In still water, 24 km requires 6 hours. Thus $X=8$ and $Y=6$.
- Plug these into the answer choices. ($8 > 6$).
- **The correct answer is A**

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MATH: WORD PROBLEMS

Percent | Answers

20

- Let P denote the original price.
- Statement (1) by itself is insufficient. If x is much larger than y , the new price is higher than the original. But if x is only marginally larger, the new price is lower. For example, if $x=20$ and $y=19$, the new price is $P \cdot 1.2 \cdot 0.81 = 0.97P < P$.
- Statement (2) by itself is insufficient. Use the same reasoning. If y is large, the new price is small (if $y=100$, the new price is 0). If y is small, the new price is higher than the original (if $x=12$ and $y=10$, the new price is $P \cdot 1.12 \cdot 0.9 = P \cdot 1.008 > P$).
- Statements (1) and (2) combined are insufficient. Adding $S1$ to $S2$ provides no new information.
- The correct answer is E.

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MATH: WORD PROBLEMS

Rate

21

- A certain bacteria colony doubles in size every day for 20 days, at which point it reaches the limit of its habitat and can no longer grow. If two bacteria colonies start growing simultaneously, how many days will it take them to reach the habitat's limit?
 - 6.33
 - 7.5
 - 10
 - 15
 - 19



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MATH: WORD PROBLEMS

Rate | Answers

22

- We know that the bacteria colony doubles in size every day for 20 days. Therefore on the second day it is double the size of the first day, and so on. Similarly, on the 20th day, it is at 100% of capacity, therefore, on the 19th day, it will be at 50%. Since we have 2 colonies, both will be occupying half of the habitat by the 19th day. Alternatively:
$$1 \text{ colony} = x \times 2^{20}; 2 \text{ colonies} = \frac{x \times 2^{20}}{2} = x \times 2^{19}$$
- **The correct answer is E. 19 days.**



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MATH: WORD PROBLEMS

Triangles

1

- Sum of angles of ANY triangle equals ?
- What can we say about sides of a triangle?
- What is the right triangle?



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MATH: GEOMETRY

Triangles 2

3

- List all methods for finding an area of a triangle.



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MATH: GEOMETRY

Triangles | Answers

2

- Sum of all angles in any triangle is always 180°
- One side is always smaller than the sum of the other two and is always greater than the difference of the other two
- A right triangle is the one that has a 90 degree angle (it has the right angle). A triangle can only have one angle at 90 degrees since sum of the 3 angles is 180



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MATH: GEOMETRY

Triangles 2 | Answers

4

- 1. Area = $\frac{1}{2} \text{ base} \times \text{height}$
- 2. Hero's formula: $\sqrt{s(s-a)(s-b)(s-c)}$
where a,b,c are sides of a triangle and s is semi-perimeter $s = \frac{a+b+c}{2}$
- 3. If you know 2 sides of a triangle but not its height, you can add an equally sized triangle to create a square/rectangle/rhombus and find its area (may be easier). Remember to divide your result by 2.



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MATH: GEOMETRY

Triangles 3

5

- These are 2 sides of a right triangle, find the third side:
 - ▣ 3, 4, x
 - ▣ 6, 8, x
 - ▣ 5, 12, x
 - ▣ 12, 16, x
 - ▣ 7, 24, x



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MATH: GEOMETRY

Triangles 4

7

- What is the relationship between sides in a right isosceles triangle?
- What is the relationship between angles?



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MATH: GEOMETRY

Triangles 3 | Answers

6

- GMAT relies on these easy triangles. If you memorize these combinations, it will save you time on the Geometry section
 - ▣ 3, 4, 5
 - ▣ 6, 8, 10
 - ▣ 5, 12, 13
 - ▣ 12, 16, 20
 - ▣ 7, 24, 25



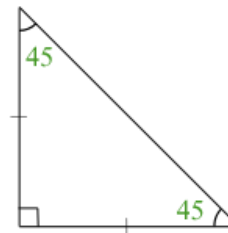
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MATH: GEOMETRY

Triangles 4 | Answers

8

- A right isosceles triangle will have angles that are 90, 45, 45 degrees
- It will have sides that are x, x, and the hypotenuse of $x\sqrt{2}$



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MATH: GEOMETRY

Triangles 5

9

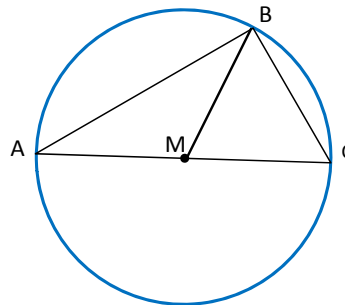
- Name as many properties, relationships, and formulas you know about and equilateral triangle



Triangles 6

11

- What can you derive from this figure?
(M is the center of a circle)



Triangles 5 | Answers

10

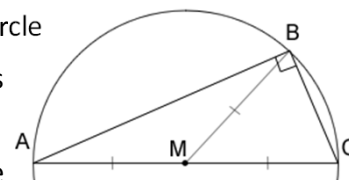
- All sides are equal
- All angles are equal
- Area = $a^2 \times \frac{\sqrt{3}}{4}$ where a is a side of a triangle
- A height is $= a \frac{\sqrt{3}}{2}$
- For a given area, an equilateral triangle has the smallest perimeter – it is the most “efficient” triangle



Triangles 6 | Answers

12

- AC is the diameter of a circle
- $R = \frac{AC}{2}$ where R is radius
- AM = MC = MB
- Angle ABC is a right angle
- If one of the sides on an inscribed triangle is the circle's diameter, then this is a right triangle regardless of the position of point B



Triangles 7

13

- What is the value of sides in a 30-60-90 triangle?



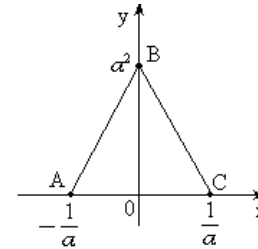
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MATH: GEOMETRY

Triangles 8 (Ultra Hard)

15

- Is the area of the triangle ABC less than 1?
 - $\angle ABC < 90$ degrees
 - Perimeter of triangle ABC is greater than $\frac{a}{4}$



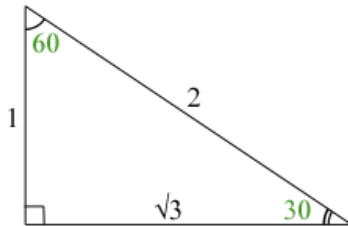
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MATH: GEOMETRY

Triangles 7 | Answers

14

- In 30-60-90 triangle, the sides are x , $x\sqrt{3}$, and the hypotenuse is $2x$ (double the size of the smallest side)



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MATH: GEOMETRY

Triangles 8 | Answers

16

- The area of the triangle ABC is $\frac{1}{2} \left(\frac{1}{a} + \frac{1}{a} \right) a^2 = a$
- Statement (1) by itself is sufficient. In the extreme case when Angle ABC is right, the triangle BOC is isosceles and thus $a^2 = \frac{1}{a}$ and the area of the triangle ABC is $a = 1$. If angle ABC is smaller than 90 degrees, then the area exceeds 1 due to the increase of the height a^2 .
- Statement (2) by itself is insufficient. As long as $a > 0$, the perimeter of the triangle ABC is always greater than $\frac{4}{a}$
- The correct answer is A.



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MATH: GEOMETRY

Circles

17

Please define the following:

- Center - ?
- Radius - ?
- Diameter - ?
- Circumference - ?
- Area - ?
- Chord - ?
- Tangent - ?
- Secant - ?



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MATH: GEOMETRY

Circles 2

19

- Area of a circle = ?
- Length of a circle = ?
- π = ?



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MATH: GEOMETRY

Circles | Answers

18

- Center – A point inside the circle. All points on the circle are equidistant from the center
- Radius – distance between the center and any point on the circle. It is half the diameter
- Diameter – a chord passing through the center
- Circumference – distance around the circle
- Area – a region enclosed by the circle
- Chord – a line segment linking any two points on a circle
- Tangent – line touching the circle at one point only; tangent lines are always at 90 degrees to the radius
- Secant – a line that intersects a circle in 2 points



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Circles 2 | Answers

20

- Area of a circle = πR^2
- Length of a circle = $2\pi R$
- $\pi = 3.14 \approx 3 \approx \frac{22}{7}$



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MATH: GEOMETRY

Coordinate Geometry

21

- What is the equation of the slope of a line?



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MATH: GEOMETRY

Coordinate Geometry 2

23

- If a line has a negative slope less than 1 – what does it say about the line?



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MATH: GEOMETRY

Coordinate Geometry | Answers

22

- Slope of a line equation:

$$\frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$$

Where x and y are coordinates of point 1 and point 2 on that line.



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MATH: GEOMETRY

Coordinate Geometry 2 | Answers

24

- Negative slope – means line moves from the upper left hand quadrant (Q2) to the bottom right hand quadrant (Q4) or in simple terms, it is a decreasing line. Positive slope means the opposite (duh)
- Since the slope is less than 1, it is a flat line (as opposed to steep). Since slope is rise over run, in this case, there is less rise than run



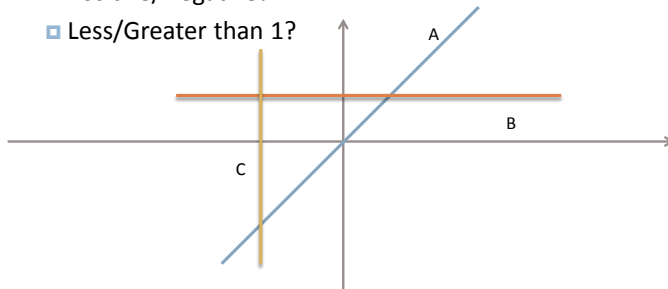
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Coordinate Geometry 3

25

- What slopes do Lines A, B, and C have?
 - ▢ Positive/Negative?
 - ▢ Less/Greater than 1?



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Coordinate Geometry 4

27

- How to find the X and Y intercepts of a line?



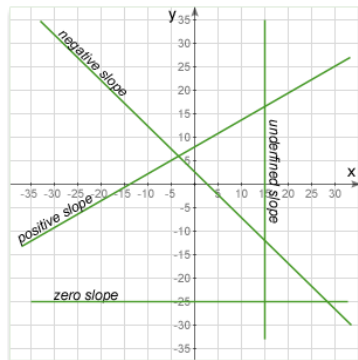
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MATH: GEOMETRY

Coordinate Geometry 3 | Answers

26

- **Line A**
 - ▢ Positive Slope
 - ▢ Slope greater than 1
- **Line B**
 - ▢ Slope is neither positive or negative
 - ▢ Slope is Zero
- **Line C**
 - ▢ Slope is undefined



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Coordinate Geometry 4 | Answers

28

- Best option is to plug in the values into the equation of the line
- For example, a line is $y = mx + b$
- To find the Y intercept (this is when the line crosses the Y axis and thus X is zero) solve: $y = b$
- To find X intercept (this is when the line crosses the X axis and Y is zero) solve: $0 = mx + b$
- The trick is to use $Y = 0$ when looking for X intercept and $X = 0$ when looking for Y intercept



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Coordinate Geometry 5

29

- If line M with a slope of $\frac{5}{9}$ goes through points $A(-5, -2)$ and $B(4, 3)$, what is the length of the segment AB ?



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Coordinate Geometry 6

31

- Find the equation of a line passing through the points **A (5,4)** and **B (2,3)**



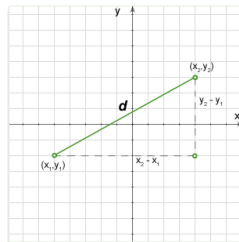
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Coordinate Geometry 5 | Answers

30

- The slope information in this irrelevant
- To find distance between A and B is calculated using the Pythagorean Theorem by drawing a triangle
- $9^2 + 5^2 = d^2$
- $\sqrt{81 + 25} = d$
- $d = \sqrt{106}$



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Coordinate Geometry 6 | Answers

32

- **A (5,4)** and **B (6,3)**
- To find an equation of a line based on two points, use this formula: $\frac{y-y_1}{x-x_1} = \frac{y_1-y_2}{x_1-x_2}$
- $\frac{y-4}{x-5} = \frac{4-3}{5-6}$; $\frac{y-4}{x-5} = \frac{1}{-1}$
- $-y + 4 = x - 5$
- $y = -x + 9$



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Coordinate Geometry 7

33

- If lines A and B are perpendicular to each other, what is the relationship between their slopes?
 - A. Inverse
 - B. Opposite
 - C. Positive
 - D. Reciprocal
 - E. Reciprocal and Negative



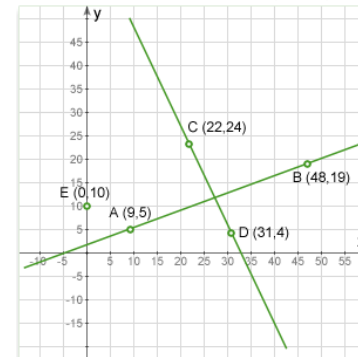
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Coordinate Geometry 8

35

- Are the two lines below perpendicular?



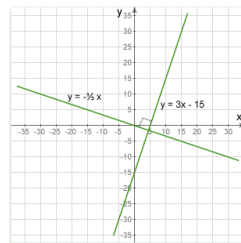
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Coordinate Geometry 7 | Answers

34

- The relationship between slopes of 2 perpendicular lines is negative reciprocal $-\frac{1}{m}$. In other words, the two lines are perpendicular if and only if the product of their slopes is -1.
- E.g. $3 \times -\frac{1}{3} = -1$



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MATH: GEOMETRY

Coordinate Geometry 8 | Answers

36

- To answer, find the slope of each line and then check to see if one slope is the negative reciprocal of the other or if their product equals to -1.
- Slope AB = $\frac{5-19}{9-48} = \frac{-14}{-39} = \frac{14}{39}$
- Slope CD = $\frac{24-4}{22-31} = \frac{20}{-9} = -\frac{20}{9}$
- Multiply the slopes: $\frac{14}{39} \times \frac{20}{9} \neq -1$;
- **Not Perpendicular**



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MATH: GEOMETRY

Coordinate Geometry 9

37

- What is the point of intersection of two lines that have the following equations: $y=3x-3$ and $y=2.3x+4$?



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MATH: GEOMETRY

Coordinate Geometry 10 (Hard)

39

- Does the curve $(x - a)^2 + (y - b)^2 = 16$ intersect the Y axis?
 - 1) $a^2 + b^2 > 16$
 - 2) $a = |b| + 5$



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MATH: GEOMETRY

Coordinate Geometry 9 | Answers

38

- The key to solving the intersection questions is that at the point of intersection, both lines will have the same X and Y coordinates.
- Thus, if Y coordinates are the same, then we can put the two equations together: $3x-3 = 2.3x+4$
- $0.7x = 7$; $x = 10$
- Now we still need to find the Y intercept. Plug 10 into one of the equations: $3*10-3 = 27$
- **Intersection point: (10, 27)**



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MATH: GEOMETRY

Coordinate Geometry 10 | Answers

40

- $(x - a)^2 + (y - b)^2 = 16$ is the equation of a circle centered at with radius 4.
- Statement (1) by itself is insufficient. S1 says that the center of the circle is further than 4 units away from the origin but it doesn't specify whether the circle is far enough from the axis not to intersect it.
- Statement (2) by itself is sufficient. From S2 it follows that and thus the center of the circle is at least 5 units away from the axis. As the radius of the circle is only 4 units, we can conclude that the circle does not intersect the axis.
- **The correct answer is B. Statement 2 is sufficient.**



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MATH: GEOMETRY

Coordinate Geometry 10 (Hard)

45

- Does the curve $(x - a)^2 + (y - b)^2 = 16$ intersect the Y axis?
 - 1) $a^2 + b^2 > 16$
 - 2) $a = |b| + 5$

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MATH: GEOMETRY

Coordinate Geometry 10 | Answers

46

- $(x - a)^2 + (y - b)^2 = 16$ is the equation of a circle centered at with radius 4.
- Statement (1) by itself is insufficient. S1 says that the center of the circle is further than 4 units away from the origin but it doesn't specify whether the circle is far enough from the axis not to intersect it.
- Statement (2) by itself is sufficient. From S2 it follows that and thus the center of the circle is at least 5 units away from the axis. As the radius of the circle is only 4 units, we can conclude that the circle does not intersect the axis.
- **The correct answer is B. Statement 2 is sufficient.**

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MATH: GEOMETRY

Enumeration

1

- There are three marbles: 1 blue, 1 gray and 1 green. In how many ways is it possible to arrange marbles in a row?

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MATH: PROBABILITY & COMBINATIONS

Enumeration 2

3

- There are three marbles: 1 blue, 1 gray and 1 green. In how many ways is it possible to arrange marbles in a row if blue and green marbles have to be next to each other?

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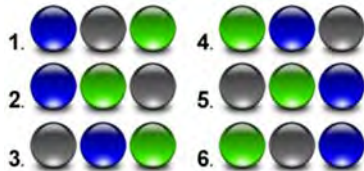
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MATH: PROBABILITY & COMBINATIONS

Enumeration | Answers

2

- **Solution:** Let's write out all possible ways
- Total: 6



- Enumeration is a method of counting all possible ways to arrange elements. Although it is the simplest method, it is often the fastest method to solve hard GMAT problems and is a pivotal principle for any other combinatorial method. In fact, combination and permutation is shortcuts for enumeration. The main idea of enumeration is writing down all possible ways and then count them.

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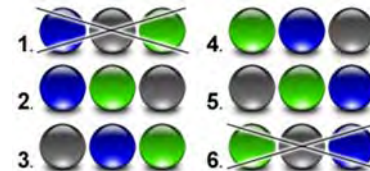
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Enumeration 2 | Answers

4

- **Solution:** Let's write out all possible ways to arrange marbles in a row and then find only arrangements that satisfy question's condition:



- Answer: 4

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MATH: PROBABILITY & COMBINATIONS

Enumeration 3

5

- In how many ways can 5 dresses be arranged in a store display?

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MATH: PROBABILITY & COMBINATIONS

Enumeration 4 (Ultra Hard)

7

- If N is a positive integer, what is the last digit of $1! + 2! + \dots + N!$?
 - N is divisible by 4
 - $\frac{N^2+1}{5}$ is an odd integer

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MATH: PROBABILITY & COMBINATIONS

Enumeration 3 | Answers

6

- 1. How many objects we can put at 1st place? **5**.
- 2. How many objects we can put at 2nd place? **4** and so on: 3, 2, 1
Therefore, the total number of arrangements of n different objects in a row is
$$N = n \times (n - 1) \times (n - 2) \dots 2 \times 1 = n!$$
- $5! = 5 \times 4 \times 3 \times 2 \times 1 = 20 \times 6 = 120$
- $N!$ is called a factorial. Factorial equals to the product of numbers from N to 1.

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MATH: PROBABILITY & COMBINATIONS

Enumeration 4 | Answers

8

- This is a very hard question that requires a non-traditional approach (as some of the hardest official GMAT questions often do)
- Analyzing factorials, you will notice that the sum of factorials will have 3 as the last digit if $N > 3$, (starting with $5!$, each sum ends with a zero since $5! = 120$, $6! = 720$, and so on.)
- $S1$ is sufficient since we know $N > 3$ and thus we can say with certainty that last digit equals to 3
- $S2$ tells us that N is not 1 or 3 and is either 2 or greater than 3. In either case, the last digit will be 3
- **The correct answer is D**

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MATH: PROBABILITY & COMBINATIONS

Combinations 1

9

- What is the number of possible arrangements of objects k from a collection of distinct objects n ?



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MATH: PROBABILITY & COMBINATIONS

Combinations 2

11

- What is the number of possible arrangements of objects k in a certain order from a collection of distinct objects n ?



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MATH: PROBABILITY & COMBINATIONS

Combinations 1 | Answers

10

- A combination is an unordered collection of k objects taken from a set of n distinct objects. The number of ways how we can choose k objects out of n distinct objects is denoted as: C_k^n
- Total number of arrangements of n distinct objects is $n!$
- Now we have to exclude all arrangements of k objects ($k!$) and remaining $(n-k)$ objects $((n-k)!)$ as the order of chosen k objects and remained $(n-k)$ objects doesn't matter.
- $C_k^n = \frac{n!}{k!(n-k)!}$



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MATH: PROBABILITY & COMBINATIONS

Combinations 2 | Answers

12

- A permutation is an ordered collection of k objects taken from a set of n distinct objects. The number of ways how we can choose k objects out of n distinct objects is denoted as: P_k^n
 1. The total number of arrangements of n distinct objects is $n!$
 2. Now we have to exclude all arrangements of remaining $(n-k)!$ Objects
- $P_k^n = \frac{n!}{(n-k)!}$



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MATH: PROBABILITY & COMBINATIONS

Combinations 3

13

- What is the difference between combinations and permutations?
- When to use which formula?

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MATH: PROBABILITY & COMBINATIONS

Combinations 4

15

- If six business partners are having a dinner at a round table, how many seating arrangements are possible?

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MATH: PROBABILITY & COMBINATIONS

Combinations 3 | Answers

14

- Permutations formula $P = \frac{n!}{(n-k)!}$ is used when sequence of choice matters (meaning a group ABC is different from BAC or CBA). Classic example is choosing nominees for 3 specific positions from a pool of 10 candidates
- Combinations formula $C = \frac{n!}{k!(n-k)!}$ is used when order of selection has no impact and once a small group is formed, it does not matter how they arrived there. Classic example is picking 3 marbles from a bag of 10

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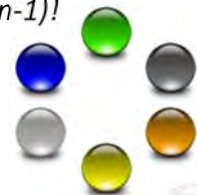
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MATH: PROBABILITY & COMBINATIONS

Combinations 4 | Answers

16

- The difference between placement in a row and that in a circle is following: if we shift all object by one position, we will get different arrangement in a row but the same relative arrangement in a circle. So, for the number of circular arrangements of n objects, instead of $n!$, we have $(n-1)!$
- Thus, the answer is $5!$ or 120



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MATH: PROBABILITY & COMBINATIONS

Combinations 5

17

- If there are 5 chairs in a room and Bob and Rachel want to sit so that Bob is always left of Rachel, in how many ways this seating arrangement be achieved?



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MATH: PROBABILITY & COMBINATIONS

Combinations 6 (Ultra Hard)

19

- In how many different ways can a group of 8 people be divided into 4 teams of 2 people each?
 - 90
 - 105
 - 168
 - 420
 - 2520



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MATH: PROBABILITY & COMBINATIONS

Combinations 5 | Answers

18

- Note that left of Rachel, does not mean immediately next to Rachel, just left of her.
- This condition is called symmetry because it eliminates half of the possibilities (Rachel can sit only left or right of Bob).
- Therefore, the number of ways that Bob is left of Rachel is exactly $\frac{1}{2}$ of all possible ways or
- $N = \frac{1}{2} \times P_5^2 = 10$



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MATH: PROBABILITY & COMBINATIONS

Combinations 6 | Answers

20

- The solution to this problem is the number of combinations. First we get one team out of 8 . The number of ways to do this would be C_8^2 . The next combination is 2 out of 6 or C_4^2 , and so on. Having all four combinations multiplied, we need to divide the total number by the number of ways the teams can be chosen , since we are not interested if the team with two certain people is chosen first, second or third. Therefore, the answer is found by the following formula: $\frac{C_8^2 \times C_6^2 \times C_4^2 \times C_2^2}{4!} = 105$
- The correct answer is B.



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MATH: PROBABILITY & COMBINATIONS

Probability 1

21

- What is the probability that an event n will occur?
- What is the probability that an event n will not occur?

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MATH: PROBABILITY & COMBINATIONS

Probability 2

23

- What is the probability of getting *Tails* when flipping a coin?



Head



Tail

- What is the probability of getting a 4 when rolling a die?



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MATH: PROBABILITY & COMBINATIONS

Probability 1 | Answers

22

- The probability that an even n will take place is $\frac{n}{N}$ where N is the total number of possible occurrences
- The probability that an even n will not occur is the opposite of it occurring, so $1 - \frac{n}{N}$ or $1 - p$

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MATH: PROBABILITY & COMBINATIONS

Probability 2 | Answers

24

- The probability of getting Tails when flipping a coin is $\frac{1}{2}$ or 50% since there are 2 total possibilities and only one outcome each time the coin is flipped
- The probability of getting a 4 when casting a die is $\frac{1}{6}$; there are a total of 6 potential possibilities (1,2,3,4,5,6) and only one chance to roll one of them.

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MATH: PROBABILITY & COMBINATIONS

Probability 3

25

- A bucket contains 10 green and 90 white marbles. If Adam randomly chooses a marble, what is the probability that it will be green?

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MATH: PROBABILITY & COMBINATIONS

Probability 4

27

- If there is a coin and a die, what is the probability of getting heads and a "4" after one flip and one toss?

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MATH: PROBABILITY & COMBINATIONS

Probability 3 | Answers

26

- The number of green marbles: $n = 10$
- The number of all marbles: $N = 10 + 90 = 100$
- Probability: $\frac{10}{100} = \frac{1}{10} = 10\%$
There is one important concept in problems with marbles/cards/balls. When the first marble is removed from a jar and not replaced, the probability for the second marble differs ($\frac{10}{100}$ vs. $\frac{10}{99}$). Whereas in case of a coin or dice the probabilities are always the same ($\frac{1}{6}$ and $\frac{1}{2}$). Usually, a problem explicitly states: it is a problem with replacement or without replacement.

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MATH: PROBABILITY & COMBINATIONS

Probability 4 | Answers

28

- Tossing a coin and rolling a die are independent events (occurrence of one event does not influence occurrence of other events). For n independent events the probability is the product of all probabilities of independent event.
- So, the probability of getting heads is $\frac{1}{2}$ and probability of getting a "4" is $\frac{1}{6}$. Therefore, the probability of getting heads and a "4" is: $\frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$

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MATH: PROBABILITY & COMBINATIONS

Probability 5

29

- If there is a 20% chance of rain on an average day, what is the probability that it will rain on the first day and will be sunny on the second?

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MATH: PROBABILITY & COMBINATIONS

Probability 6

31

- There are two sets of cards with numbers: {1,3,6,7,8} and {3,5,2}. If Robert chooses randomly one card from the first set and one card from the second set, what is the probability of getting two odd numbers?

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MATH: PROBABILITY & COMBINATIONS

Probability 5 | Answers

30

- The probability of rain is 0.2; therefore probability of sunshine is $q = 1 - 0.2 = 0.8$. This yields that the probability of rain on the first day and sunshine on the second day is:
 $P = 0.2 * 0.8 = 0.16$
- **Note:** when working with percents, it is important to convert them into a decimal format (such as 0.2 for 20% or a fraction format such as $\frac{1}{5}$ for 20%)

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MATH: PROBABILITY & COMBINATIONS

Probability 6 | Answers

32

- There is a total of 5 cards in the first set and 3 of them are odd: {1, 3, 7}. Therefore, the probability of getting odd card out of the first set is $\frac{3}{5}$.
- There are 3 cards in the second set and 2 of them are odd: {3, 5}. Therefore, the probability of getting an odd card out of the second set is $\frac{2}{3}$. Finally, the probability of getting two odd integers is: $\frac{3}{5} \times \frac{2}{3} = \frac{2}{5}$ or 40%

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MATH: PROBABILITY & COMBINATIONS

Probability 7

33

- If Jessica rolls a die, what is the probability of getting at least a "3"?

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MATH: PROBABILITY & COMBINATIONS

Probability 8

35

- There are 8 employees including Bob and Rachel. If 2 employees are to be randomly chosen to form a committee, what is the probability that the committee includes both Bob and Rachel?

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MATH: PROBABILITY & COMBINATIONS

Probability 7 | Answers

34

- Two events are mutually exclusive if they cannot occur at the same time. For n mutually exclusive events the probability is the sum of all probabilities of events:
 $P(A \text{ or } B) = P(A) + P(B)$
- There are 4 outcomes that satisfy our condition (to roll at least 3): {3, 4, 5, 6}. The probability of each outcome is $\frac{1}{6}$.
- The probability of getting at least a "3" is:
 $\frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{4}{6} = \frac{2}{3}$

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MATH: PROBABILITY & COMBINATIONS

Probability 8 | Answers

36

- **Combinatorial approach:**
 - The total number of possible committees is $C_2^8 = 28$
 - The number of possible committee that includes both Bob and Rachel is 1
 - $P = \frac{1}{28}$
- **Probability approach:**
 - The probability of choosing Bob or Rachel as a first person in committee is $\frac{2}{8}$. The probability of choosing Rachel or Bob as a second person when first person is already chosen is $\frac{1}{7}$. The probability that the committee includes both Bob and Rachel is $\frac{1}{28}$

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MATH: PROBABILITY & COMBINATIONS

Probability 8 – Part 2

37

- There are 8 employees including Bob and Rachel. If 2 employees are to be randomly chosen to form a committee, what is the probability that the committee includes both Bob and Rachel?

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MATH: PROBABILITY & COMBINATIONS

Probability 8 – Part 3

39

- There are 8 employees including Bob and Rachel. If 2 employees are to be randomly chosen to form a committee, what is the probability that the committee includes both Bob and Rachel?

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MATH: PROBABILITY & COMBINATIONS

Probability 8 – Part 2 | Answers

38

- **Reverse Combinatorial Approach:**
 - Instead of counting probability of occurrence of certain event, sometimes it is better to calculate the probability of the opposite and then use formula $p = 1 - q$.
 - The total number of possible committees is $C_2^8 = 28$
 - The number of possible committee that does not include both Bob and Rachel is: $m = C_2^6 + 2 \times C_1^6$ where, C_2^6 is the number of committees formed from 6 remaining people
 $2 \times C_1^6$ is the number of committees formed from Rob or Rachel and one out of 6 other people
 - $P = 1 - \frac{m}{N} = 1 - \frac{C_2^6 + 2 \times C_1^6}{C_2^8} = 1 - \frac{15 + 2 \times 6}{28} = 1 - \frac{27}{28} = \frac{1}{28}$

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MATH: PROBABILITY & COMBINATIONS

Probability 8 – Part 3 | Answers

40

- **Reverse probability approach:**
 - We can choose any first person.
 - Then, if we have Rachel or Bob as the first choice, we can choose any other person out of the 6 remaining people.
 - If we have neither Rachel nor Bob as first choice, we can choose any person out of the remaining 7 people.
 - The probability that the committee includes both Bob and Rachel is: $P = 1 - \left(\frac{2}{8} \times \frac{6}{7} + \frac{6}{8} \times 1 \right) = 1 - \frac{27}{28} = \frac{1}{28}$

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MATH: PROBABILITY & COMBINATIONS

Probability 9

41

- Julia and Brain play a game in which Julia takes a ball and if it is green, she wins. If the first ball is not green, she takes the second ball (without replacing first) and she wins if the two balls are white or if the first ball is gray and the second ball is white. What is the probability of Julia winning if the jar contains 1 gray, 2 white and 4 green balls?

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MATH: PROBABILITY & COMBINATIONS

Probability 9 | Answers

42

- Sometimes, at 700+ level you may see complex probability problems that include conditions or restrictions. For such problems it could be helpful to draw a probability tree that include all possible outcomes and their probabilities.

- Now, It is pretty obvious:

$$P = \frac{4}{7} + \frac{2}{7} \times \frac{1}{6} + \frac{1}{7} \times \frac{2}{6} = \frac{2}{3}$$



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MATH: PROBABILITY & COMBINATIONS

Recommended Math GMAT Books

- ❑ **Need to start from the beginning?**
 - ❑ [MGMAT Math Foundations](#)
- ❑ **Need a good level of practice?**
 - ❑ [Kaplan Math Workbook](#)
- ❑ **Need the most practice?**
 - ❑ [MGMAT Math Guides](#) or [Veritas Prep Math Guides](#)
 - ❑ [Quantitative GMAT Official Guide](#) 2nd ed
 - ❑ [GMAT Total Math](#)
- ❑ **GMAT book reviews:** <http://gmatclub.com/books>

Best Math GMAT Courses

- **Kaplan Math Refresher Course - \$299 or Free**
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VERBAL STRATEGIES

Contents of Flash Cards

2

- Basic Strategies and Principles of Sentence Correction, Critical Reasoning, and Reading Comprehension with a few examples
- Illustration of errors and right answer choices through examples

Critical Reasoning

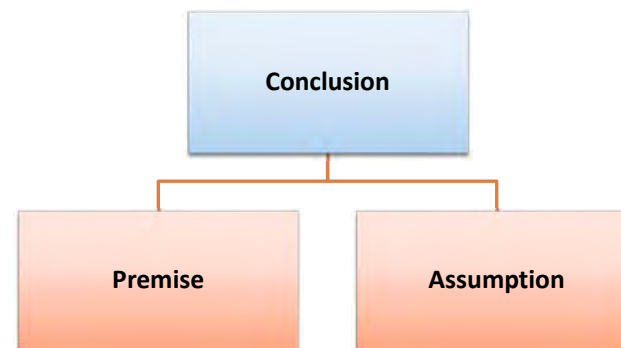
Basic Deconstruction

- **Step 1:** Read the question stem and categorize the question.
- **Step 2:** Read the stimulus and identify the premise and the conclusion
- **Step 3:** Try to focus on the conclusion and think of answer choices that might be right
- **Step 4:** Use process of elimination to rule out wrong answer choices. Don't try to make them fit!
- **Step 5:** Make sure answer choice makes sense!

Contents

- Main Point / Must Be True
- Weaken
- Strengthen
- Assumption
- Resolve the Paradox
- Reasoning
- Bold Faced
- Numbers and Percents

Main parts of a CR question



Main parts of a CR question

5

- **Conclusion:** This is the final argument that the author makes.
- **Premise:** These are evidentiary statements that support the conclusion
- **Assumption:** These are unstated premises, on which the conclusion and sometimes the premise rest on.



Type I – Ascertain Conclusion

7

- These are questions where we **assume that the stimulus is true** and try to find **answer choices that are supported by the conclusion**
- Possible Question Types:
 1. Inference
 2. Main Point
 3. Must-be-True



Premise & Conclusion

6

PREMISE	CONCLUSION
Supports the conclusion – Answers the question of “Why?”	Has a tone of finality and conveys the final message of what the author is saying
Because	Thus
Since	Therefore
For/For the reason	Hence
Due to	So
As indicated by	As a result of/Consequently
Furthermore	Accordingly
Given that	It follows that/It must be that



Type II – Strengthen & Support

8

- These are questions where **we assume that the given answer choices are true** and try to pick the **best one that will support the stimulus**
- Possible Question Types:
 1. Strengthen
 2. Assumption



Type III – Weaken and Hurt

9

- This is basically the opposite of the above type and aims to **disprove the conclusion of the stimulus**. Hence **we take the answer choice to be true** here as well.
- Possible Question Types:
 1. Strengthen
 2. Assumption

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VERBAL

Most Common Mistake Types

11

Out of Scope/Irrelevant Answers

- ❖ Talks about something completely irrelevant to the discussion at hand.
- ❖ People tend to pick these when they're completely unsure of what they're supposed to be doing

Tone Mismatch Answers

- ❖ Answers that don't agree with the tone of the passage
- ❖ Might be too strong or too weak when compared to stimulus

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Most Common Mistake Types

10

Opposite Answers

- ❖ Does the opposite of what the answer choice is supposed to do
- ❖ People pick them because they might get confused about the question type

Shell Game Answers

- ❖ Sounds really similar to the stimulus but differs by just the right amount to be incorrect but still lucrative.
- ❖ People pick these when they're not paying close attention

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Main Point/Must-Be-True

12

"Which of the following represents the main idea of the paragraph?"
"Which of the following can be inferred from the above?"

Correct Answer Choices

- Can this answer choice be proven or validated by what is given in the stimulus? Is this answer choice true to the stimulus AND the main point of the passage, i.e. similar to the conclusion?
- Should be validated by the stimulus (Stimulus is taken to be true)
- Should be the main point of the stimulus, not just a premise (for Main Point questions)
- Will either restate conclusion or present it in a different manner

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A B C D E

13

To be considered for this year's merit scholarship award, students need to have perfect attendance and a 4.0 GPA. Alex is the only person in the class who has a 4.0 but he has had 5 absences.

The claims above, if true, most strongly support which of the following conclusions?

- A. No student at this school has perfect attendance for the year
- B. Some students at this school who did not have a 4.0 also did not have perfect attendance
- C. Alex is the only student who could be considered for the award
- D. No student at this school qualifies for the award this year
- E. Many students have achieved perfect attendance but never 4.0 GPAs.

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Weaken

15

"Which of the following, if true, calls into question the validity of the argument?"

"Which of the following most seriously undermines the conclusion?"

Correct Answer Choices

- Does this answer choice break down causality? Does it give an alternate cause, show that the cause-effect relationship is non-existent or reversed?
- Answer choice should break down structure of stimulus (Answer is taken to be true)
- Could be in relation to a gross generalization, a wrong conclusion or incorrect hypothesis from facts.

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A B C D E

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A: Exaggeration.

B: Possible, but not necessary

C: The stimulus clearly says that you need both perfect attendance and 4.0 GPA.

D: This is true. If Alex is the only one who has a 4.0 and he doesn't have a perfect attendance, it means the entire school is barred from qualifying for the award. Correct choice.

E: Out of scope answer.

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A B C D E

17

There are 350 brands of cell phones in the market today. However, our store only stocks the top 10 brands. In order to increase our sales, we plan to increase the size of our inventory to the top 50 brands.

Which of the following, if true, points out a major flaw in the plan above?

- A. The capabilities of the top five cell phones are almost the same, with no brand having consistent superiority in all respects.
- B. The top 8 brands account for almost all the cell phones sold
- C. As users get more sophisticated, they want to try out the lesser known brands which might offer some other value to them.
- D. Less popular brands provide little profit to the store because they have to be discounted to be sold
- E. The leading brands are now losing sales to less popular brands that offer similar features for a lower cost

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Strengthen

19

"Which of the following, if true, strengthens the argument the most?"
"Which of the following, if true, would most significantly help prove the scientist's hypothesis?"

Correct Answer Choices

- Does this answer choice reinforce the conclusion directly? Does it validate an assumption or rule out a discrepancy? Does it help establish causality?
- Answer choice should strengthen structure of stimulus (Answer is taken to be true)
- Needs to directly strengthen conclusion by bridging logical gaps, validating reasons or assumptions or finding missing links. If it's not a direct strengthening, move on! Don't try to make the connections!

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A B C D E

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A: Irrelevant. Does this affect profit margins for the store if they were to increase inventory? No

B: This means that the store already has the brands that sell the most. Increasing inventory will have little effect on profit margins. Correct Answer.

C: This almost strengthens the argument.

D: This tells you that the lesser brands will provide lesser profit. But "less" is a relative term. This is an unclear statement.

E: This almost strengthens the argument by favoring an increase in inventory. Hence incorrect.

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20

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A B C D E

21

Recently, several companies have withdrawn their ads from Magazine A, because the editorial board of the magazine had decided to change the image that the magazine portrays from one of family values to one concerned more with sex and violence. Surely this indicates that the decision-makers in advertising agencies do still have a sense of moral propriety that occasionally drives their actions.

Which of the following, if true, would strengthen this conclusion?

- A) The advertisers regularly review the placement of their advertisements.
- B) It is a rare event for several advertisers to withdraw all their advertisements simultaneously from a publication.
- C) The advertisers, when questioned, admitted that their clients would lose revenue as a result of the advertisements being withdrawn.
- D) The advertisers all placed new advertisements with other publications that emphasised family values.
- E) A survey of the readership of Magazine X suggested that the majority of the readership think that the standard of the magazine's contents had failed since its transformation.

Question from GMAT Club (95810)

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Assumption

23

“The author assumes which of the following in saying that ...”
 “The argument cannot be true unless which of the following statements are assumed?”

Correct Answer Choices

- **Supporter:** Links unrelated elements in the stimulus and fills in logical gaps
- **Defender:** Eliminates the alternatives and any choices that might weaken the conclusion.
- **Assumption Negation Technique:** Narrow it down to the final answer choices and then negate them – the main modifier or a verb (such that the meaning of the sentence is reversed) and if the negated choice weakens the conclusion, the answer is right.

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VERBAL

A B C D E

22

- A:** This is irrelevant to the question of moral propriety.
- B:** This doesn't necessarily point to moral propriety directly. Don't make unnecessary connections!
- C:** Once again, no correlation to what we're talking about
- D:** If this is true, then it shows that the agencies care about where their ads go. Hence correct.
- E:** This is about the magazine. Not the advertisers.

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VERBAL

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VERBAL

A B C D E

25

In theory, it's possible that bacteria developed on Mars early in its history and some were carried to Earth by a meteorite. However, strains of bacteria from different planets would probably have substantial differences in protein structure that would persist over time, and no two bacterial strains on Earth are different enough to have arisen on different planets. So, even if bacteria did arrive on Earth from Mars, they must have died out.

The argument is most vulnerable to which of the following criticisms?

- A. It fails to establish whether bacteria actually developed on Mars.
- B. It fails to establish how likely it is that Martian bacteria were transported to Earth.
- C. It fails to consider whether there were means other than meteorites by which Martian bacteria could have been carried to Earth.
- D. It fails to consider whether all bacteria now on Earth could have arisen from transported Martian bacteria.
- E. It fails to consider whether there could have been strains of bacteria that originated on Earth and later died out.

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Question from GMAT Club (80725)

VERBAL

Resolve the Paradox

27

“Which of the following, if true, helps explain the paradox above?”
 “Which of the following, if true, helps explain the apparent discrepancy in the argument?”

Correct Answer Choices

- **Active Resolution:** Don't try to disprove the stimulus, take it as a given.
- **Does the answer choice address the facts?** The answer choice MUST conform to the stimulus
- The answer should address BOTH sides of the paradox, and resolve it. It shouldn't strengthen the paradox.

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A B C D E

26

- A:** This is irrelevant to the argument that states that even if bacteria came from Mars, they must have died out.
- B:** Out of Scope!
- C:** Again, this doesn't talk about bacteria strains dying out
- D:** If this is true, then there need not have to be any significant difference between the strains found on Earth, since they all originated from Mars.
- E:** We are not concerned about this.

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VERBAL

28

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VERBAL

A B C D E

29

A severe drought can lessen the total amount of government aid that US farmers receive as a group. The government pays farmers the amount, if any, by which the market price at which crops are actually sold falls short of a preset target price per bushel for the crops. The drought of 1983, for example, caused farm-program payments to drop by \$10 billion.

Given the information above, which of the following, if true, best explains why the drought of 1983 resulted in a reduction in farm-program payments?

- A. Prior to the drought of 1983, the government raised the target price for crops in order to aid farmers in reducing their debt loads.
- B. Due to the drought of 1983, United States farmers exported less food in 1983 than in the preceding year.
- C. Due to the drought of 1983, United States farmers had smaller harvests and thus received a higher market price for the 1983 crop than for the larger crop of the preceding year.
- D. Due to the drought of 1983, United States farmers planned to plant smaller crops in 1984 than they had in 1983.
- E. Despite the drought of 1983, retail prices for food did not increase significantly between 1982 and 1983.

Question from GMAT Club (80726)



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Reasoning

31

“Which of the following most accurately describes the author’s method of defending the case?”

“Which of the following is most parallel to the argument in logical structure?”

Correct Answer Choices

- Should follow the same pattern of reasoning. Focus on the logic, not the content of the argument!
- **Answer choice must be a description of the author’s logic!**
- Answer choice should not be inconsistent with the stimulus, even if the stimulus has flawed logic. We are not asked to evaluate the logic of the stimulus; we are merely asked to find an answer that follows the same pattern – right or not.



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VERBAL

A B C D E

30

A: Strengthens the paradox.

Amount Paid = Target – Market. We can’t say anything unless we know what happened to the market price.

B: Exports are irrelevant here.

C: This talks about the higher market prices. This could explain the paradox because target – market will become lesser if market becomes higher

D: Size of crops is irrelevant.

E: Between 1982-1983? Retail price? Out of Scope!



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32



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A B C D E

33

Shakespeare was the world's greatest playwright, which means that he must have written the world's greatest plays. The fact that he wrote the greatest plays in the world only goes to prove that he is the world's greatest playwright.

Which of the following statements best matches the argument shown above?

- A. Dr. Smith is the only member of the twenty-strong English department who thinks that Byron wrote greater poetry than Keats. Therefore Byron was not as good a poet as Keats was.
- B. A miscarriage of justice occurs when an innocent person is sent to prison. However, there are no miscarriages of justice because people in prison are guilty. Otherwise they would not have been sent to prison.
- C. The presence of enlarged white corpuscles in the blood would indicate that the patient must be suffering from disease X. However, his blood sample contains no enlarged white corpuscles, so he cannot be suffering from disease X.
- D. Blair denies having committed the robbery, but has implicated Brown. Brown on the other hand, claims that he was elsewhere at the time, and points the finger squarely back at Blair.
- E. I believe that the presence of the tartar sauce helps to accentuate the flavour of the other ingredients, but they in turn release chemicals which tend to neutralise the tartar sauce. Therefore the dish is much less spicy than pure tartar sauce would be.

Question from GMAT Club (92697)

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Bold Faced Questions

35

“The two bold faced sentences play which of the following roles?”

Correct Answer Choices

- ☐ Should address both the boldfaced portions, not just one.
- ☐ **Will be true to the stimulus and mimic the reasoning in the stimulus!**
- ☐ Answer choice should not be inconsistent with the stimulus, and it should follow the same logical pattern in order to arrive at the argument of the stimulus. .

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A B C D E

34

- A:** This calls for making a judgment based on someone's opinion. Not true.
- B:** This is true. The argument in the stimulus is a circular argument that says A proves B and then uses B to prove A. A similar pattern exists here.
- C:** This has a negation effect in the reasoning. Not relevant.
- D:** Shell game answer. Might seem like circular logic, but it's actually just a circular sequence of events.
- E:** Some kind of contradictory reasoning. Not relevant.

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VERBAL

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VERBAL

A B C D E

37

Although the earliest surviving Greek inscriptions written in an alphabet date from the eighth century B.C., a strong case can be made that the **Greeks actually adopted alphabetic writing at least two centuries earlier**. Significantly, the text of these earliest surviving Greek inscriptions sometimes runs from right to left and sometimes from left to right. Now, the Greeks learned alphabetic writing from the Phoenicians, and in the process **they would surely have adopted whatever convention the Phoenicians were then using with respect to the direction of writing**. Originally, Phoenician writing ran in either direction, but by the eighth century B.C. it had been consistently written from right to left for about two centuries.

In the argument given, the two portions in boldface play which of the following roles?

- A. The first is the position that the argument seeks to establish; the second reports a discovery that has been used to support a position that the argument opposes.
- B. The first is the position that the argument seeks to establish; the second presents an assumption on which the argument relies.
- C. The first presents evidence that is used in support of the position that the argument seeks to establish; the second presents an assumption on which the argument relies.
- D. The first is an objection raised against a position that the argument opposes; the second is the position that the argument seeks to establish.
- E. The first is an objection raised against a position that the argument opposes; the second is evidence that has been used to support that position.

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Question from GMAT Club (98749)

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Numbers & Percents

39

- Larger numbers doesn't mean larger percentage and smaller number doesn't mean smaller percentage. For example, $\frac{2}{3} > \frac{90}{243}$
- Increase in percentage is not the same as saying there is an increase in absolute numbers. This could merely be the result of a change in the group size. For example, 5% of 100 > 10% of 50.

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A B C D E

38

- A:** The second boldfaced portion doesn't represent a discovery; it's an assumption
- B:** This is true. The first part is a clause the stimulus wants to prove and the second is an assumption
- C:** The first boldfaced portion doesn't object to any statement.
- D:** The first boldfaced portion doesn't object to any statement.
- E:** The first boldfaced portion doesn't object to any statement.

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A B C D E

41

A recent survey of all auto accident victims in Dole County found that, of the severely injured drivers and front-seat passengers, 80 percent were not wearing seat belts at the time of their accidents. This indicates that, by wearing seat belts, drivers and front-seat passengers can greatly reduce their risk of being severely injured if they are in an auto accident.

The conclusion above is not properly drawn unless which of the following is true?

- A. Of all the drivers and front-seat passengers in the survey, more than 20 percent were wearing seat belts at the time of their accidents.
- B. Considerably more than 20 percent of drivers and front-seat passengers in Dole County always wear seat belts when travelling by car.
- C. More drivers and front-seat passengers in the survey than rear-seat passengers were very severely injured.
- D. More than half of the drivers and front-seat passengers in the survey were not wearing seat belts at the time of their accidents.
- E. Most of the auto accidents reported to police in Dole County do not involve any serious injury.

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Question from GMAT Club (28035)

Reading Comprehension

A B C D E

42

A: This is a tricky question. Our aim is to prove a correlation. Let's say 100 people were severely injured and 100 were not. Out of the 100 severely injured, 80 didn't wear seat belts.

Probability of a person not wearing seat belt to get injured = $\frac{80}{100} = 80\%$

Probability of a person wearing seat belt to get injured = $\frac{20}{120} = 16.7\%$

B: Doesn't establish the correlation between what's being said. Hence incorrect.

C: This doesn't even give us a relative indication. Incorrect.

D: This tells us about the number of people who were not wearing seat belts, but not about the number of people who were injured.

E: Completely irrelevant to the scope of the discussion.

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Contents

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- **Global Questions**
 - Main Point / Primary Purpose
 - Passage Organization
 - Author's Perspective / Passage Tone
- **Local Questions**
 - Specific Reference
 - Function
 - Strengthen and Weaken
 - Parallel Reasoning Question

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Four Questions for RC

45

- Read from general to specific at three levels. Change your reading strategy, not your reading speed. Answer the following questions.
- **Why?** Main Point of the passage.
- **How?** Structure of the passage – Introduction, Example and Counter-Example. And so on.
- **What?** What is being said? (Main Point of Individual Paragraphs)
- **What Tone?** Make sure answer choice makes sense!

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Common Indicators

47

Main Point or Strong Purpose

- Very Common Question Type
- Primary goal of reading passage – Find the main point!

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New vs. Existing Ideas

46

CONTINUATION OF OLD IDEAS	INTRODUCTION OF NEW IDEAS
Continues elaborating on an idea that's already been presented	Introduces another new idea, perhaps to contrast something presented.
Furthermore	However
For Instance	But
For Example	Nevertheless
Additionally	Yet
Similarly	In Contrast
Indeed	Although
In fact	Still

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Common Indicators

48

Difficult Words, Phrases & Concepts

- Very Common Distraction
- Don't focus on the difficulty of the words or terminologies
- Instead, choose to focus on the underlying meaning of what it's saying

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Common Indicators

49

List of Things/Enumerations

- Pay close attention!
- Don't memorize!
- Very common question indicator. Make a mental note of where the list occurs, so you can return to it, if necessary.

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Common Indicators

51

Dates and Numbers

- Match the correct dates with the events mentioned
- Perhaps, make a note of the dates and a short-hand version of the event on your notepad.

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Common Indicators

50

Reference with Authority

- If authorities are mentioned, think about how and why this authoritative remark is necessary.
- Might represent conflicting view points or ideas.
- Make note of what each authority says and why their authority is relevant.
- Very, very important, and very easy to misinterpret!

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Common Indicators

52

Hidden References

- Ideas that are mentioned more than once in the passage.
- Even if the question cites a line number for one of the references, the answer choice might draw on the same idea mentioned elsewhere, or another part of the passage.

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Common Indicators

53

Contrasting Views

- If several view points are presented in the passage, make note of each point and who's saying it/why it's being said.
- Understanding of these counter-examples or views are very important! They will be indicated by words such as "However" or "In contrast"

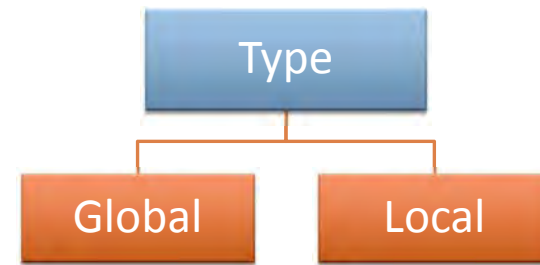
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Basic Question Types

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Common Indicators

54

Definitions

- Common when the passage is of scientific nature
- Make a note of the definition and expect to be questioned about your understanding of the definition

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Question Types

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Global – Broad Questions

- Main Point/Primary Purpose
- Passage Organization
- Author's Perspective/Passage Tone

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Broad Questions

57

Main Point/Primary Purpose

- Represents Core Ideas
- Will ask about the broader meaning of the passage, and what it seeks to convey.

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Broad Questions

59

Author's Perspective/Tone of Passage

- These questions ask you to reflect on an author's perspective
- Understand what the author is trying to say, and where he or she stands with respect to the views presented.
- Is the author aggressive? Or is the author docile? What is the tone of the message conveyed?

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Broad Questions

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Passage Organization

- This will ask about the structure of a passage
- For instance, the structure might be something like this:
 - Introduction
 - Example
 - Counter-Example

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Question Types

60

Local – Specific Questions (Four Types)

- Specific Reference
- Function
- Strengthen and Weaken
- Parallel Reasoning Question

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Local Questions

61

Specific Reference

- Will refer to a specific line or paragraph in the passage and ask for a question relating to that.
- Might involve cross-referencing with other relevant information presented elsewhere in the passage

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Local Questions

63

Strengthen/Weaken

- Similar to Critical Reasoning Questions of the same type.
- The required answer will either help or hurt the conclusive view point presented by the author, i.e. the main point
- Assume the answer choices given to be true.

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Local Questions

62

Function

- Questions about what a piece of the passage – either a paragraph, a line or even a word is trying to accomplish with respect to the broader scope of the passage
- Try to infer something about the context and tone of the specific reference, and ask yourself – “What does this line do?”

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Local Questions

64

Parallel Reasoning

- Again, similar to Critical Reasoning Question of the same type
- Will ask to identify an action, among given actions, or a view point that mimics the reasoning that the author follows.
- Identifying the structure of the passage and the structure of a line within a passage as necessary would greatly help!

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RC in a Nutshell

65

- **The right mentality :** The passage **WILL** be intentionally confusing. Get used to it!
- **Awareness of content:** The passages might be from humanities, social sciences or sciences. **Don't get bogged down by one kind or get excited about another**
- **Reading Pattern:** General to Specific

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Sentence Correction

RC in a Nutshell

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- **Understand question types:** Global or Local
- **Pre-phrase:** Frame a rough answer before you pick answer choices!
- **Process of Elimination:** Don't keep an answer that you have to make connections for.

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Contents

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- **Subject Verb Agreement**
- **Verb Tense Errors**
- **Noun Agreement**
- **Pronouns**
- **Modifiers**
- **Comparisons**
- **Parallelism**

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Deconstructing SC

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- **Step 1:** Read the question stem and think of possible errors in the sentence, subject-verb agreement, tense mismatch etc.
- **Step 2:** Read the answer choice and split it into two groups based on overall structure.
- **Step 3:** One of the groups will contain an error. Eliminate the group and re-split the next group.
- **Step 4:** Use process of elimination to rule out wrong answer choices. Don't try to make them fit!
- **Step 5:** Make sure the answer choice makes sense!

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And what's not?

71

Three Question Types You Won't See

- **Spelling** – The GMAT will not test you on your knowledge of spellings
- **Punctuation** – Adding a comma or an apostrophe and similar things will not be tested. Semi-colons, however, are tested.
- **Capitalization** – The GMAT doesn't test you on your knowledge of capitalization either.

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What's Tested?

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Three Question Types You Will See

- **Grammar** – The sentence has to adhere to the rules of grammar followed by Standard English.
- **Meaning** – The sentence has to have a relevant meaning and convey it properly
- **Concision** – If what is being said can be said in five words instead of ten, then the former is preferred (Active vs. Passive voice, for example)

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Errors Tested

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Subject-Verb Agreement

- This deals with the issue of plurality.
- Singular subjects must use singular verbs. For example: He **was** eating.
- Plural Verbs must use plural verbs. For example: The elephants **were** walking.

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Trap 1: Phrases between subject and verb

73

Remove the additional information and read the sentence without them.

- Barely seventeen and leading the French army wearing a man's armor, Joan of Arc, **an illiterate peasant girl from the French countryside**, broke the seven month-old seize of Orleans in nine days.
- Reading the sentence without that part we have:
Barely seventeen and leading the French army wearing a man's armor, Joan of Arc, broke the seven month-old seize of Orleans in nine days.

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Trap 3: Multiple Nouns or Pronouns

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- If there is more than one noun or the usage of a pronoun in a sentence, then the subject-verb agreement **MUST** be consistent!!
- **Two Exceptions:**
 - Conjunctions (OR, NOR) – Always SINGULAR
 - Usage of EACH or EVERY – Always SINGULAR

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Trap 2: Subject Follows Verb

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- If there are expletives, then check for subject-verb agreement, by rearranging the sentence.
- **Some common expletives:**
 - There
 - Here
 - It
 - Or

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Trap 4: Indefinite Pronouns

76

- Pronouns like all, any, more, most, somebody, nobody and so on.
- Plurality is based on what the indefinite pronoun is referring to! (This is the antecedent)
- **Exceptions:**
 - Each, Either, Neither, Every, Number – Always singular irrespective of what follows!
 - Example: A number of reasons –Plural! The number of cars – Singular! ("the" is singular and "a" is plural)

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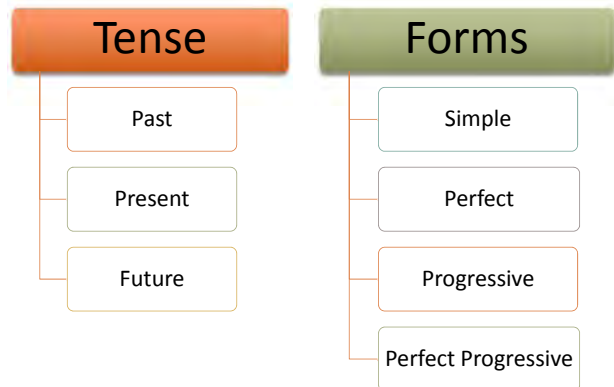
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Errors Tested

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Verb Tense



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Noun Agreement

- The number of nouns must be consistent with what they are referencing.
- **Incorrect:** Matt and Dave believed that their hard work in their engineering class will help them realize their dream of becoming a great engineer.
- **Correct:** Matt and Dave believed that their hard work in their engineering class will help them realize their dream of becoming great engineers.

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Errors Tested

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Verb Tense – Sub Types

- Incorrect Verb Tense
- Shift in Verb Tense
- Verb Voice

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Errors Tested

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Use of Pronouns

- Pronoun-Antecedent Disagreement
- Incorrect Use of Relative Pronouns
- Ambiguous and Implied Pronouns

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Pronoun Error Sub Types

81

Pronoun Antecedent Disagreement

- The pronoun **MUST** refer to it's antecedent.
- The pronoun-antecedent relationship should be consistent throughout the sentence.
- **Incorrect:** Each of the women selected for the scholarship were asked to submit an application.
- **Correct:** Each of the women selected for the scholarship was asked to submit an application.

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Trap 2: Indefinite Pronouns

83

- These are very general pronouns – many, few, both, every and so on.
- **Incorrect:** Many of the students were surprised to learn that his or her exam was unfairly graded.
- **Correct:** Many of the students we surprised to learn that their exams was unfairly graded.

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Trap 1: Distance btw. pronoun & antecedent

82

- This happens when there is additional information between the pronoun and antecedent making it easy to lose track of the relationship between pronouns and their antecedents.
- **Incorrect:** The library, with it's many books and databases, require a special membership.
- **Correct:** The library, with it's many books and databases, requires a special membership.

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Trap 3: Misleading Antecedents

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- Antecedents that **SOUNDS** plural but actual are singular or vice versa.
- For example, family is singular, and persons is singular too. It might be a group of people in a family, but being a collective noun, it's still singular!

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Pronoun Error Sub Types

85

Incorrect use of relative pronouns

- They relate groups of words to a noun or pronoun – which, whom, whomsoever, where and why.
- Two traps of incorrect usage:
 - ▢ Incorrect Pronoun Choice for People and Things
 - ▢ Difference between who and whom

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Trap 2: Who vs. Whom?

87

- Very simple trick!
- Make the following substitutions:
 - ▢ He – Who
 - ▢ Him – Whom
- The substitution that makes sense will correspond with the correct word in that context.
- Sometimes it might be necessary to rearrange the sentence for it to make sense.

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Trap 1: Pronoun Choice

86

- Who and Whom will always relate to people.
 - ▢ The doctor that performed the surgery was honored – should be “who”
- That and Which will always relate to things, i.e. inanimate objects.
 - ▢ The machine who performed the surgery was showcased in the exhibit – should be “that”

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Errors Tested

88

Modifiers

- Misplacement of adjectives (describes nouns - serene) and adverbs (describe verbs - serenely)
- For example: The new BMW model is designed to drive faster and more **efficient** than the previous model.
 - ▢ The usage of the word “efficient” is wrong here since it’s modifying the verb. The correct word usage would be “efficiently”

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Trap 1: Quantifiers

89

- Errors in Count Nouns (can be counted – trees, bottles, billions). Quantifiers are many, both, few, several, a couple and so on.
- Errors in Non-Count Nouns (cannot be counted – water, liquid). Quantifiers are much, a little, a bit and so on.
- Some modifiers like all, and some can be used for both.

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Trap 2: Placement

91

- Misplaced modifiers with relative clauses (like that or which)
 - **Incorrect:** According to the report, bicycles will be confiscated that have not been registered with the university.
 - **Correct:** According to the report, bicycles that have not been registered with the university will be confiscated.

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Trap 2: Placement

90

- Misplaced modifiers are modifiers that are placed in the wrong position on a sentence.
 - **Incorrect:** Short on money, the car was the best one Tanya could find.
 - **Correct:** Short on money, Tanya knew that the car was the best one she could find.
- Dangling Modifiers are those where the referent is completely absent.
 - **Incorrect:** Walking to the university, the cat had to stop.
 - **Correct:** Walking to the university, he had to stop because of his cat.

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Errors Tested

92

Comparisons

- Incorrect use of comparative degree
- Illogical Comparisons

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Comparison Sub Type

93

Degree of Comparison

- When there are two objects being compared, you have to use a comparative word. When more than two objects are compared, you have to use a superlative word.
- **Incorrect:** Though the reporters felt that injury played a part in Tennessee's loss to Minnesota, Tennessee's coach said that Minnesota had the best team that night.
- **Correct:** Though the reporters felt that injury played a part in Tennessee's loss to Minnesota, Tennessee's coach said that Minnesota had the better team that night.

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Errors Tested

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Parallelism

- Parallel Verbs and Verb Form Errors
- Parallel Noun Errors
- Parallel Prepositions and Articles
- Parallel Conjunctions
- Parallel Comparisons

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Comparison Sub Type

94

Illogical Comparison

- Only similar objects can be compared. You cannot compare a human to a dog.
- **Incorrect:** Though the recent Lays food poisoning incident has caused some buyers to question its quality, the Lays chips are sold more often than any other food company.
- **Correct:** Though the recent Lays food poisoning incident has caused some buyers to question its quality, the Lays chips are sold more often than those produced by any other food company.

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Parallelism Sub Type

96

Verb Errors

- Nouns are naturally parallel. But when they are in the form with an –ing at the end (gerunds), they are confused for verbs.
- **Incorrect:** The common symptoms of the stomach flu are indigestion, vomiting and drinking less water than usual.
- **Correct:** The common symptoms of the stomach flu are indigestion, vomiting and decreased water intake.

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Parallelism Sub Type

97

Noun Errors

- When a sentence has two or more similar parts linked by a conjunction, each part has to be of the same verb form.
 - **Incorrect:** The new exam pattern requires students to enter their student IDs and signing their names on the roster.
 - **Correct:** The new exam pattern requires students to enter their student IDs and sign their names on the roster.

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Parallelism Sub Type

99

Parallel Conjunctions

- The conjunctions used must be parallel in structure.
- Some examples:

Neither ... nor	Either ... or
Not only ... but also	Both ... and
Whether ... or	As ... as

- **Incorrect:** The restaurant not only hired a new chef, but **it** also expanded its seating capacity.
- **Correct:** The restaurant not only hired a new chef, but also expanded its seating capacity.

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Parallelism Sub Type

98

Prepositional/Article Errors

- A preposition and an article must either be used by all parts of a sentence or by just the first part.
 - **Incorrect:** By doing each assignment, turning in homeworks on time and by attending all the classes, one might be able to obtain the highest grade in the class.
 - **Correct:** By doing each assignment, turning in homeworks on time, and attending all the classes, one might be able to obtain the highest grade in the class.

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Parallelism Sub Type

100

Parallel Comparisons

- When comparisons are left unparallel, that can amount to an error as well.
 - **Incorrect:** In the book, the author mentions that he found editing pictures much more arduous and difficult than when he had to take the actual pictures.
 - **Correct:** In the book, the author mentions that he found editing pictures much more arduous and difficult than taking pictures.

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Errors Tested

101

Semi Colons

- Usage of fragments or dependent clauses on either side of a semi-colon
- **Incorrect:** The guinea pig is not a true pig; rather, a rodent that belongs to the Caviidae family.
- **Correct:** The guinea pig is not a true pig, but rather a rodent that belongs to the Caviidae family.
- **Correct:** The guinea pig is not a true pig; it's a rodent that belongs to the Caviidae family.

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Errors Tested

103

Idioms

- Very, very common error tested.
- A phrase that is commonly accepted as correct even though its grammatically inconsistent
- An idiom error will misrepresent the idiom.
- Idioms are provided with right and wrong usage in the cards that follow.

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Errors Tested

102

Wordiness and Redundancy

- The GMAT will prefer usage of the most concise sentences possible.
- **Incorrect:** He decided to not purchase the car due to the fact that it was too expensive.
- **Correct:** He decided to not purchase the car because it was too expensive.
- **Incorrect:** In addition to playing the guitar, Rob **also** plays the viola.
- **Correct:** In addition to playing the guitar, Rob plays the viola.

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Errors Tested Idiom Rules

104

Among vs. Between

Among:

- Used when more than two items are in question.
- Example: He was the best among three candidates.

Between:

- Used when two items are in question
- Example: He was the best between the two of them.

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Errors Tested Idiom Rules

105

Both vs. Each

Both:

- Used to point out similarities.
- Example: Both of them were good at swimming.

Each:

- Used to point out differences/dissimilarities. (Always singular)
- Example: Each girl had her own niche.

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Errors Tested Idiom Rules

107

Each Other vs. One Another

Each Other:

- Used to compare two things.
- Example: They loved each other dearly.

One another:

- Used to compare more than two things.
- Example: The three brothers loved one another dearly.

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Errors Tested Idiom Rules

106

Twice vs. Double

Twice:

- Twice/Thrice etc. are used for comparison
- Example: The Toyota was twice as fast as the Honda.

Double:

- Used as a verb only.
- Example: He more than doubled his wealth by investing in stocks.

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Errors Tested Idiom Rules

108

If vs. Whether

If:

- Primarily used only in "If ... else" sentences.
- Example: If this is true, the market will collapse. Else, it will be okay tomorrow.

Whether:

- Used more frequently as a comparison.
- Example: Whether or not he chooses to accept the prize is up to him.

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Errors Tested Idiom Rules

109

Like vs. Such As

Like:

- Used when indicating similarities between things.
- Example: Like John, Amy was a violinist too.

Such as:

- Used to list examples.
- Example: There are different kinds of tigers such as the Bengal Tigers, white tigers and so on.

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Errors Tested Idioms

111

Agree upon/to

- **Correct:** We agreed upon the date of the meeting
- **Incorrect:** We agreed to the date of the meeting.

- **Correct:** We agreed to share our room.
- **Incorrect:** We agreed upon sharing our room.

Allow for

- **Correct:** One must always allow for a margin of error while calculating axial loads.
- **Incorrect:** One must always allow to have a margin of error while calculating axial loads.

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Errors Tested Idioms

110

Ability To

- **Correct:** Dolphins have the ability to emit low frequency whistles
- **Incorrect:** Dolphins have the ability of emitting low frequency whistles.

Act as/like

- **Correct:** A signature can act as a legal attetato.
- **Incorrect:** A signature can act like a legal attetato.
- **Correct:** He was acting like a child.
- **Incorrect:** He was acting as a child.

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Errors Tested Idioms

112

Appeal to

- **Correct:** I appealed to his sense of justice.
- **Incorrect:** I appealed for his sense of justice.

Are in danger of

- **Correct:** The giant panda bears are in danger of extinction.
- **Incorrect:** The giant panda bears have a danger of dying from deforestation.

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Errors Tested Idioms

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As an adolescent

- **Correct:** As an adolescent, he suffered from attention disorder
- **Incorrect:** While in adolescence, he suffered from attention disorder.

As good as

- **Correct:** It's as good as new.

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Errors Tested Idioms

115

Attribute to

- **Correct:** I attribute my success to hard work.
- **Incorrect:** I attribute my success with hard work.

Base on

- **Correct:** The decision was made based on multiple criteria.
- **Incorrect:** The decision was made based of multiple criteria.

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Errors Tested Idioms

114

Associate with

- **Correct:** I associate spring with flowers.
- **Incorrect:** I always associate water to Niagara falls.

Attend to

- **Correct:** I have to attend to some duties
- **Incorrect:** I have to attend for some duties.

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Errors Tested Idioms

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Begin to see daylight

- **Correct:** After working on the project all night, I am finally beginning to see daylight.
- **Incorrect:** After working on the project all night, I am finally beginning to view the daylight.

Between <> and <>

- **Correct:** I had to choose between chocolates and cakes.
- **Incorrect:** I had to choose between chocolates with cakes.

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Errors Tested Idioms

117

Care for/about

- **Correct:** I don't care much for sweets
- **Correct:** I care about her a lot.

Claim to/Claim that

- **Correct:** I never claimed to possess remarkable singing talent.
- **Incorrect:** I never claimed that possess remarkable singing talent.
- **Correct:** I never claimed that I possessed remarkable talent.

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Errors Tested Idioms

119

Consider (as)

- **Correct:** I don't consider him a serious contender
- **Incorrect:** I don't consider him with a serious contender

Conform to

- **Correct:** You must conform to the standards
- **Incorrect:** You must conform with the standards

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Errors Tested Idioms

118

Come to a dead end

- **Correct:** He came to a dead end after researching topics.
- **Incorrect:** He came by a dead end after researching topics.

Compare to/with

- **Correct:** I never compared myself to her.
- **Incorrect:** I never compared myself for her.
- **Correct:** Let's compare the pros of the situation with the cons.
- **Incorrect:** Let's compare the pros of the situation for the cons.

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Errors Tested Idioms

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Contrast to/with

- **Correct:** In contrast to the previous report, this one is better
- **Incorrect:** In contrast with the previous report, this one is better.
- **Correct:** The red background contrasts nicely with the blue flowers
- **Incorrect:** The red background contrasts nicely to the blue flowers.

Count on

- **Correct:** I knew that I could count on you.
- **Incorrect:** I knew that I could count for you.

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Errors Tested Idioms

121

Credit for/to/with

- **Correct:** You should take credit for what you did.
- **Incorrect:** You should take credit to what you did.

- **Correct:** I credit my success to my hard work.
- **Incorrect:** I credit my success for my hard work.

- **Correct:** He is credited with the discovery of penicillin.
- **Incorrect:** He is credited for/to the discovery of penicillin.

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Errors Tested Idioms

123

Declared <>

- **Correct:** The teacher declared all exams worthy.
- **Incorrect:** The teacher declared all exams as worthy.

Define as

- **Correct:** Light is defined as radiation.
- **Incorrect:** Light is defined for radiation.

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Errors Tested Idioms

122

Debate about

- **Correct:** There was a raging debate about standards.
- **Incorrect:** There was a raging debate for standards.

Decide on

- **Correct:** I am yet to decide on a color for the wall.
- **Incorrect:** I am yet to decide about a color for the wall.

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Errors Tested Idioms

124

Delighted to

- **Correct:** I am delighted to accept this prize.
- **Incorrect:** I am delighted for accepting this prize.

Different from

- **Correct:** This sandwich is different from the others.
- **Incorrect:** This sandwich is different with the others.

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Errors Tested Idioms

125

Distinguish between/from

- **Correct:** I had to distinguish between good and bad.
- **Incorrect:** I had to distinguish from good and bad.

- **Correct:** I had to distinguish good from bad.
- **Incorrect:** I had to distinguish good with bad.

Draw a line

- **Correct:** We had to draw a line somewhere.
- **Incorrect:** We had to draw the line before.

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Errors Tested Idioms

127

Draw to

- **Correct:** He was drawn to her from the moment he met her.
- **Incorrect:** He was drawn for her from the moment he met her.

Easier said than done

- **Correct:** It's always easier said than done.
- **Incorrect:** It's always easier said than to be done.

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Errors Tested Idioms

126

Draw attention to

- **Correct:** I hate to draw attention to the fact that the quality of food has gone down.
- **Incorrect:** I hate to draw attention for the fact that the quality of food has gone down.

Draw upon

- **Correct:** We had to draw upon the reserves to keep the car running.
- **Incorrect:** We had to draw on the reserves to keep the car running.

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Errors Tested Idioms

128

Elect as/to

- **Correct:** He was elected to office.
- **Incorrect:** He was elected to officer.

- **Correct:** He was elected as an officer.
- **Incorrect:** He was elected as office.

Easier said than done

- **Correct:** It's always easier said than done.
- **Incorrect:** It's always easier said than to be done.

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Errors Tested Idioms

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Indicate that

- **Correct:** Studies indicate that stress is a common cause of heart attacks.
- **Incorrect:** Studies indicate about stress being a common cause of heart attacks.

In order to

- **Correct:** She began studying in order to get a good grade in the class.
- **Incorrect:** She began studying in order that she got a good grade in the class.

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Errors Tested Idioms

131

Left, right and center

- **Correct:** She was shooting emails to people left, right and center.
- **Incorrect:** She was, left right and center, sending emails.

Known to

- **Correct:** Even as a student, Rick was known to do things differently.
- **Incorrect:** Even as a student, Rick was known as wanting to do things differently.

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Errors Tested Idioms

130

Just as <>, so <>

- **Correct:** Just as Tyra was considered for the scholarship, so was Mia.
- **Incorrect:** Just as Tyra was considered for the scholarship, Mia as also considered.

Known to

- **Correct:** Even as a student, Rick was known to do things differently.
- **Incorrect:** Even as a student, Rick was known as wanting to do things differently.

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Errors Tested Idioms

132

A means to

- **Correct:** She only viewed it as a means to the end.
- **Incorrect:** For some people, money is considered a means for/of an end.

Mistaken for

- **Correct:** The twins were often mistaken for one another.
- **Incorrect:** The twins were often mistaken as one another.

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Errors Tested Idioms

133

More than ever

- **Correct:** I regret not going to Europe, now more than ever.
- **Incorrect:** I regret not going to Europe, now more than never.

Native of/to

- **Correct:** She is a native of Vienna.
- **Incorrect:** She is a native to Vienna.
- **Correct:** The Bengal Tiger is native to India.
- **Incorrect:** The Bengal Tiger is native of India.

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Errors Tested Idioms

135

Reluctant to

- **Correct:** She was reluctant to take on such a huge task.
- **Incorrect:** She was reluctant about taking on such a huge task.

Require of

- **Correct:** It is required of all candidates to report here daily.
- **Incorrect:** It is required from all candidates to report here daily.

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Errors Tested Idioms

134

Prohibit from

- **Correct:** Only when we prohibit people from buying drinks for minors, will we reduce the problem of underage drinking.
- **Incorrect:** Only when we prohibit people to buy drinks for minors, will we reduce the problem of underage drinking.

Range from

- **Correct:** The quality of these products range from good to excellent.
- **Incorrect:** The quality of these products range between good to excellent.

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Errors Tested Idioms

136

Seem to

- **Correct:** He seemed to be hiding something in his pocket.
- **Incorrect:** He seemed as he was hiding something in his pocket.

Take advantage of

- **Correct:** He took advantage of all the opportunities he had.
- **Incorrect:** He took advantage for all the opportunities he had.

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VERBAL

Idioms

137

Which sentence is idiomatically correct?

- A. Will Ferrell's cameo scenes are **so funny as** anything he's ever done.
- B. Will Ferrell's cameo scenes are **as funny that** anything he's ever done.
- C. Will Ferrell's cameo scenes are **as funny as** anything he's ever done.

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Idioms

139

Which sentence is idiomatically correct?

- A. The market **has confidence that** the firm **will add back** leverage to increase profits.
- B. The market **has confidence in** the firm's **ability to add back** leverage to increase profits.
- C. The market **has confidence in** the firm **to add back** leverage to increase profits.

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Idioms

138

Correct answer:

- A.
- B.
- C. Will Ferrell's cameo scenes are **as funny as** anything he's ever done.

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Idioms

140

Correct answer:

- A. The market **has confidence that** the firm **will add back** leverage to increase profits.
- B.
- C.

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VERBAL

Idioms

141

Which sentence is idiomatically correct?

- A. What these scores tell us is that rigor **is lacking in** some schools.
- B. What these scores tell us is that some schools **lack of** rigor.
- C. What these scores tell us is that **there's a lack of** rigor in some schools.

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Idioms

143

Which sentence is idiomatically correct?

- A. The city industrialists have **demanded** the state government **to meet** the promises made by chief minister Ashok Chavan.
- B. The city industrialists have **demanded that** the state government **meet** the promises made by chief minister Ashok Chavan.
- C. The city industrialists have **demanded that** the state government **met** the promises made by chief minister Ashok Chavan.

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Idioms

142

Correct answer:

- A. What these scores tell us is that rigor **is lacking in** some schools.
- B.
- C.

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Idioms

144

Correct answer:

- A.
- B. The city industrialists have **demanded that** the state government **meet** the promises made by chief minister Ashok Chavan.
- C.

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Idioms

145

Which sentence is idiomatically correct?

- A. Tensions have flared in some parts of the country **between** blacks **with** Hispanics.
- B. Tensions have flared in some parts of the country **between** blacks **and** Hispanics.
- C. Tensions have flared in some parts of the country **among** blacks **and** Hispanics.

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Idioms

147

Which sentence is idiomatically correct?

- A. The problem is Disney's **ability to take** control of some of the best-known characters quickly is very limited.
- B. The problem is Disney's **ability of taking** control of some of the best-known characters quickly is very limited.
- C. The problem is Disney's **ability for taking** control of some of the best-known characters quickly is very limited.

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Idioms

146

Correct answer:

- A.
- B. Tensions have flared in some parts of the country **between** blacks **and** Hispanics.
- C.

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Idioms

148

Correct answer:

- A. The problem is Disney's **ability to take** control of some of the best-known characters quickly is very limited.
- B.
- C.

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VERBAL

Idioms

149

Which sentence is idiomatically correct?

- A. A reading above 50 percent **indicates** the manufacturing economy **to be** generally expanding.
- B. A reading above 50 percent **indicates that** the manufacturing economy **is** generally expanding.
- C. A reading above 50 percent **indicates** the manufacturing economy **is** generally expanding.

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Idioms

151

Which sentence is idiomatically correct?

- A. **In contrast to** the first two options **centralizing** decision making, a Cap and Trade system will not.
- B. **As contrasted with** the first two options, a Cap and Trade system **will decentralize** decision making.
- C. **In contrast to** the first two options, a Cap and Trade system **will decentralize** decision making.

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Idioms

150

Correct answer:

- A.
- B. A reading above 50 percent **indicates that** the manufacturing economy **is** generally expanding.
- C.

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Idioms

152

Correct answer:

- A.
- B.
- C. **In contrast to** the first two options, a Cap and Trade system **will decentralize** decision making.

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Idioms

153

Which sentence is idiomatically correct?

- A. This report has been issued by the association since 1931, **excepting** a four-year interruption during World War II.
- B. This report has been issued by the association since 1931, **except for** a four-year interruption during World War II.
- C. This report has been issued by the association since 1931, **with the exception of** a four-year interruption during World War II.

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Idioms

155

Which sentence is idiomatically correct?

- A. Its gross margin rose **from 22% up to 25%**, but its operating margin fell **from 7% down to 4%**.
- B. Its gross margin rose **from 22% to 25%**, but its operating margin fell **from 7% to 4%**.
- C. Its gross margin rose **from 22% until 25%**, but its operating margin fell **from 7% till 4%**.

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Idioms

154

Correct answer:

- A.
- B. This report has been issued by the association since 1931, **except for** a four-year interruption during World War II.
- C.

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Idioms

156

Correct answer:

- A.
- B. Its gross margin rose **from 22% to 25%**, but its operating margin fell **from 7% to 4%**.
- C.

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Idioms

157

Which sentence is idiomatically correct?

- A. "I believe that wealth is **a means for** an end, not an end in itself".
- B. "I believe that wealth is **a means of** an end, not an end in itself".
- C. "I believe that wealth is **a means to** an end, not an end in itself".

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Idioms

159

Which sentence is idiomatically correct?

- A. The ancient Chinese Taoists **distinguished** intercourse **and** orgasm.
- B. The ancient Chinese Taoists **distinguished** intercourse **from** orgasm.
- C. The ancient Chinese Taoists **distinguished** **between** intercourse **and** orgasm.

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Idioms

158

Correct answer:

- A.
- B.
- C. "I believe that wealth is **a means to** an end, not an end in itself".

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Idioms

160

Correct answer:

- A.
- B.
- C. The ancient Chinese Taoists **distinguished** **between** intercourse **and** orgasm.

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Idioms

161

Which sentence is idiomatically correct?

- A. It would have been **easy enough for her to buy** a ranch-style house that she could easily and logically decorate with Scandinavian-style furniture.
- B. It would have been **easy enough so that she bought** a ranch-style house that she could easily and logically decorate with Scandinavian-style furniture.
- C. It would have been **easy enough as to buy** a ranch-style house that she could easily and logically decorate with Scandinavian-style furniture.

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Idioms

163

Which sentence is idiomatically correct?

- A. iPhone users download two to four times **as many more** games, video, and other Web data **than** other smartphone users.
- B. iPhone users download two to four times **as many more** games, video, and other Web data **as** other smartphone users.
- C. iPhone users download two to four times **as many** games, video, and other Web data **as** other smartphone users.

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Idioms

162

Correct answer:

- A. It would have been **easy enough for her to buy** a ranch-style house that she could easily and logically decorate with Scandinavian-style furniture.
- B.
- C.

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Idioms

164

Correct answer:

- A.
- B.
- C. iPhone users download two to four times **as many** games, video, and other Web data **as** other smartphone users.

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Idioms

165

Which sentence is idiomatically correct?

- A. We have **one chance in a million of** winning the World Cup.
- B. We have **one in a million chances to** win the World Cup.
- C. We have **one chance in a million for** winning the World Cup.

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Idioms

167

Which sentence is idiomatically correct?

- A. Our economic well-being is generally **determined from** the amount of goods and services that we consume.
- B. Our economic well-being is generally **determined by** the amount of goods and services that we consume.
- C. Our economic well-being is generally **determined through** the amount of goods and services that we consume.

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Idioms

166

Correct answer:

- A. We have **one chance in a million of** winning the World Cup.
- B.
- C.

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Idioms

168

Correct answer:

- A.
- B. Our economic well-being is generally **determined by** the amount of goods and services that we consume.
- C.

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Idioms

169

Which sentence is idiomatically correct?

- A. She **is credited for** solving numerous cases.
- B. She **is credited with** solving numerous cases.
- C. She **is credited as being** a great detective.

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Idioms

171

Which sentence is idiomatically correct?

- A. Why hasn't Congress **mandated that** the total premium cost **be** shown as wages on every pay stub but not taxed?
- B. Why hasn't Congress **a mandate for** the total premium cost **to be** shown as wages on every pay stub but not taxed?
- C. Why hasn't Congress **mandated that** the total premium cost **are** shown as wages on every pay stub but not taxed?

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Idioms

170

Correct answer:

- A.
- B. She **is credited with** solving numerous cases.
- C.

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Idioms

172

Correct answer:

- A. Why hasn't Congress **mandated that** the total premium cost **be** shown as wages on every pay stub but not taxed?
- B.
- C.

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Idioms

173

Which sentence is idiomatically correct?

- A. A 13-year-old girl was mistakenly abducted in March 2008 by traffickers who were believed to **have mistaken** her **as** the niece of a suspected drug dealer.
- B. A 13-year-old girl was mistakenly abducted in March 2008 by traffickers who were believed to **have mistaken** her **for** the niece of a suspected drug dealer.
- C. A 13-year-old girl was mistakenly abducted in March 2008 by traffickers who were believed to **have mistaken** her **to** the niece of a suspected drug dealer.

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Idioms

175

Which sentence is idiomatically correct?

- A. But both **consider** the problems **as** necessary inconveniences to feature their conferences and programs.
- B. But both **consider** the problems **to be** necessary inconveniences to feature their conferences and programs.
- C. But both **consider** the problems necessary inconveniences to feature their conferences and programs.

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Idioms

174

Correct answer:

- A.
- B. A 13-year-old girl was mistakenly abducted in March 2008 by traffickers who were believed to **have mistaken** her **for** the niece of a suspected drug dealer.
- C.

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Idioms

176

Correct answer:

- A.
- B.
- C. But both **consider** the problems necessary inconveniences to feature their conferences and programs.

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Idioms

177

Which sentence is idiomatically correct?

- A. The drug maker **proposed** the litigation **be** centralized in the US District Court for the Northern District of Ohio.
- B. The drug maker **proposed that** the litigation **is to be** centralized in the US District Court for the Northern District of Ohio.
- C. The drug maker **proposed that** the litigation **be** centralized in the US District Court for the Northern District of Ohio.

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Idioms

179

Which sentence is idiomatically correct?

- A. The astronauts would probably best use their remaining time living and working on Mars **instead of** dying at home.
- B. The astronauts would probably best use their remaining time living and working on Mars **rather** dying at home.
- C. The astronauts would probably best use their remaining time living and working on Mars **rather than** dying at home.

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Idioms

178

Correct answer:

- A.
- B.
- C. The drug maker **proposed that** the litigation **be** centralized in the US District Court for the Northern District of Ohio.

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Idioms

180

Correct answer:

- A.
- B.
- C. The astronauts would probably best use their remaining time living and working on Mars **rather than** dying at home.

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Idioms

181

Which sentence is idiomatically correct?

- A. The company **requires** him **hold** stock valued at \$4.4 million, four times his annual base salary of \$1.1 million.
- B. The company **requires** him **to hold** stock valued at \$4.4 million, four times his annual base salary of \$1.1 million.
- C. The company **requires** him **holding** stock valued at \$4.4 million, four times his annual base salary of \$1.1 million.

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Idioms

183

Which sentence is idiomatically correct?

- A. Cuban poverty **is a result of** the American trade embargo.
- B. **The result of** the American embargo **was** Cuba impoverished.
- C. **Resulting from** the American embargo, Cuba impoverished.

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Idioms

182

Correct answer:

- A.
- B. The company **requires** him **to hold** stock valued at \$4.4 million, four times his annual base salary of \$1.1 million.
- C.

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Idioms

184

Correct answer:

- A. Cuban poverty **is a result of** the American trade embargo.
- B.
- C.

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Idioms

185

Which sentence is idiomatically correct?

- A. **A rising of** electricity prices fuelled the 18 percent year-on-year jump in the company's revenues to 3.6 billion zlotys.
- B. **A rise in** electricity prices fuelled the 18 percent year-on-year jump in the company's revenues to 3.6 billion zlotys.
- C. **A raise in** electricity prices fuelled the 18 percent year-on-year jump in the company's revenues to 3.6 billion zlotys.

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VERBAL

Idioms

187

Which sentence is idiomatically correct?

- A. **It seems like** the company **is** slowly running out of new features to add.
- B. The company **seems as if it is** slowly running out of new features to add.
- C. **It seems as if** the company **is** slowly running out of new features to add.

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Idioms

186

Correct answer:

- A.
- B. **A rise in** electricity prices fuelled the 18 percent year-on-year jump in the company's revenues to 3.6 billion zlotys.
- C.

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Idioms

188

Correct answer:

- A.
- B.
- C. **It seems as if** the company **is** slowly running out of new features to add.

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Idioms

189

Which sentence is idiomatically correct?

- A. Sweet potatoes are **native in** Central America and Peru.
- B. Sweet potatoes are **native from** Central America and Peru.
- C. Sweet potatoes are **native to** Central America and Peru.

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VERBAL

Idioms

191

Which sentence is idiomatically correct?

- A. **Every product** use **similar** recycled papers, cardboard and other materials, in addition to lead-free paints, non toxic glues and inks.
- B. **All products** use **similar** recycled papers, cardboard and other materials, in addition to lead-free paints, non toxic glues and inks.
- C. **Each product** use **similar** recycled papers, cardboard and other materials, in addition to lead-free paints, non toxic glues and inks.

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Idioms

190

Correct answer:

- A.
- B.
- C. Sweet potatoes are **native to** Central America and Peru.

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Idioms

192

Correct answer:

- A.
- B. **All products** use **similar** recycled papers, cardboard and other materials, in addition to lead-free paints, non toxic glues and inks.
- C.

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Idioms

193

Which sentence is idiomatically correct?

- A. The lead-in from 'Dancing With the Stars' **will be** high, **and so too** the expectations.
- B. The lead-in from 'Dancing With the Stars' **will be** high, **and also** the expectations.
- C. The lead-in from 'Dancing With the Stars' **will be** high, **and so too will be** the expectations.

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VERBAL

Idioms

195

Which sentence is idiomatically correct?

- A. The average price has risen at least 1 cent per gallon per day for eight consecutive days to \$2.952, 10 cents **as much as** a week ago.
- B. The average price has risen at least 1 cent per gallon per day for eight consecutive days to \$2.952, 10 cents **more than** that of a week ago.
- C. The average price has risen at least 1 cent per gallon per day for eight consecutive days to \$2.952, 10 cents **more from** a week ago.

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Idioms

194

Correct answer:

- A.
- B.
- C. The lead-in from 'Dancing With the Stars' **will be** high, **and so too will be** the expectations.

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Idioms

196

Correct answer:

- A.
- B. The average price has risen at least 1 cent per gallon per day for eight consecutive days to \$2.952, 10 cents **more than** that of a week ago.
- C.

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VERBAL

Idioms

197

Which sentence is idiomatically correct?

- A. Sponsors increasingly **use the Internet like a** direct media channel to customers.
- B. Sponsors increasingly **use the Internet to be a** direct media channel to customers.
- C. Sponsors increasingly **use the Internet as a** direct media channel to customers.

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Idioms

199

Which sentence is idiomatically correct?

- A. Haz had **a way of speaking** that was less like giving information and more like warnings and omens.
- B. Haz had **a way for speaking** that was less like giving information and more like warnings and omens.
- C. Haz had **a way to speak** that was less like giving information and more like warnings and omens.

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Idioms

198

Correct answer:

- A.
- B.
- C. Sponsors increasingly **use the Internet as a** direct media channel to customers.

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Idioms

200

Correct answer:

- A. Haz had **a way of speaking** that was less like giving information and more like warnings and omens.
- B.
- C.

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VERBAL

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