

Percent

1

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



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?



Percent | Answers

2

- Percent Formula:
Part = Percent x Whole
- For example, 15% of 20 is:
$$\frac{15}{100} * 20 = \frac{300}{100} = 3$$



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)



Percent 3

5

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



Percent 4

7

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



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



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:
 - $50\% * 25 = x * 25\%$
 - $50 = x$



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



Odd/Even Rules 2

11

- Is 0 odd or even?



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)



Odd/Even Rules 2 | Answers

12

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



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. $2b + 2$



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



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)



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.**



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?



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



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



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**



Number Properties

21

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



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?
 - $x > 0$
 - $y = 4$



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**



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.**



Number Properties 3

25

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



Multiples

27

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



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



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...



Multiples 2

29

- Is 0 (zero) a multiple of 100?



Multiples 3

31

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



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*



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



Multiples 4

33

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



Translate

35

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



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



Translate Answers

36

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



Arithmetic to Memorize

37

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



Arithmetic to Memorize 2

39

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



Arithmetic to Memorize | Answers

38

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



Arithmetic to Memorize 2 | Answers

40

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



Arithmetic to Memorize 3

41

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



Arithmetic to Memorize 4

43

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



Arithmetic to Memorize 3 | Answers

42

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



Arithmetic to Memorize 4 | Answers

44

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



Arithmetic to Memorize 5

45

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



Arithmetic to Memorize 6

47

□ Complete the following:

□ 8, 16, 24, 32, 40, 160

□ 12, 24, 36.... 120

□ 15, 30... 150



Arithmetic to Memorize 5 | Answers

46

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



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



Arithmetic to Memorize 7

49

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



Reciprocal

51

- What is a reciprocal?



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
 - $2^6 = 64$
 - $\sqrt[3]{125} = 5$
 - $\sqrt[5]{243} = 3$



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 $\frac{6}{5}$.



Absolute Value

53

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



Absolute Value 2

55

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



Absolute Value | Answers

54

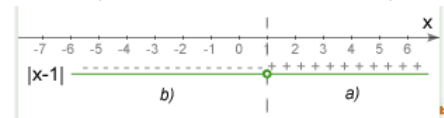
- **Step1:** Open modulus and set conditions. To solve/open a modulus, you need to consider 2 situations to find all roots:
 - ▣ Positive (or rather non-negative)
 - ▣ Negative
- **Step 2:** Solve new equations from Step 1
- **Step 3:** Check conditions for each solution from Step 2



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 ($x - 1 \geq 0$ & $x - 1 < 0$)
 - ▣ $5 - 1 = 4 \geq 0$
 - ▣ $-3 - 1 = -4 < 0$



Absolute Value 3

57

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



Absolute Value 4

59

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



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!



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.**



Factors

61

- How many total factors does 462 have?



Factors 2

63

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



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: $2 \times 2 \times 2 \times 2 = 2^4 = 16$



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.



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



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



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.**



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)



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



Powers 3

71

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



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}



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



Powers 4

73

□ $(3^3)^2 = ?$



Powers 5

75

□ $3^{3^3} = ?$



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 ($2 * 3$)



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.



Powers 6

77

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



Powers 7

79

□ $5^0 = ?$



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



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.



Powers 8

81

□ $4^{\frac{1}{2}} = ?$



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



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 $2^{\frac{1}{2}} = \sqrt{2}$



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 n 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.**



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?



Consecutive Numbers

87

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



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



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 $-3.5 \times 12 = -42$.



Evenly Spaced Set

89

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



Recurring Decimal

91

- Express 0.393939... in a fraction format



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, $\frac{9+24}{2} \times 6 = 99$



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: $\frac{13}{33}$



Fractions (Extra Hard)

93

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

- $c = 2$

- $a = b + c$



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**

