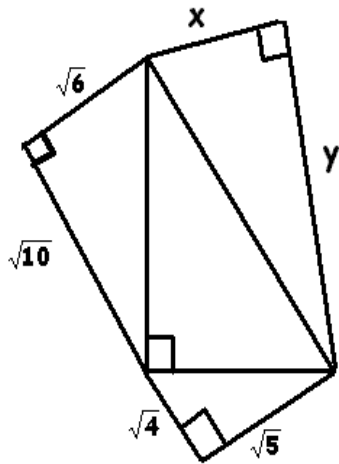1.    If $\dfrac{y + x}{y} = 2$ and $\dfrac{z + x}{z} = 3$, what is the value of $\dfrac{y}{z}$?

A. $\dfrac{5}{2}$   B.  2   C. $\dfrac{3}{2}$   D.  1   E. $\dfrac{2}{3}$

---



2.  In the figure above, $x^2 + y^2 =$

A.    5       B.    7       C.    25
D.    80      E.    625

---

3.  The longest of 4 rods of unequal lengths is 70 centimeters and the shortest is 50 centimeters. If x centimeters is the average (arithmetic mean) length of the 4 rods, which of the following indicates all possible values of x and only those possible values?

A.  50 < x < 70
B.  51 < x < 69
C.  54 < x < 64
D.  55 < x < 65
E.  59 < x < 61

---

4.  A "word" is defined as a sequence of three dots arranged in a row.  Each dot is colored either red or green.  Two such "words" are said to be different if at least one pair of corresponding dots has different colors, for example, if the second dot of one sequence is colored red and the second dot of the second sequence is colored green.  How many different "words" can be formed?
A.  3  B.  5  C.  6  D.  8  E  9

---

5,  If $\dfrac{1}{1 + \dfrac{1}{x}} = k$, which of the following equals 2k?

A. $\dfrac{2}{2 + \dfrac{2}{x}}$   B. $\dfrac{2}{1 + \dfrac{2}{x}}$   C. $\dfrac{1}{\dfrac{1}{2} + \dfrac{1}{2x}}$

D. $\dfrac{1}{1 + \dfrac{1}{2x}}$   E. $\dfrac{1}{2 + \dfrac{1}{2x}}$

---

6.  Given four distinct lines, exactly two of which are parallel, which of the following could be the number of points where at least two of the lines intersect?
I.    Three    II.    Four    III.    Five
A.  I only    B.  III only   C.  I and II only
D.  I and III only  E.  I, II, and III

---

7.  If B is 125 per cent of C, then C is what per cent of B?

A.  50%   B.  $66\dfrac{2}{3}$%  C.  75%  D.  80%  E.  90%

---

8. If one side of a ruler is to be marked in 1/8 inch units and in 1/10 inch units on the same edge, how man different such marks are needed from the 1-inch mark to the 2-inch mark, including the end-points?
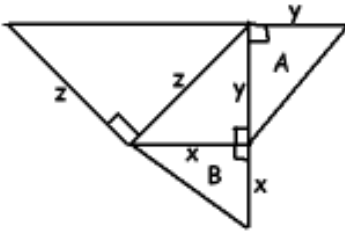A.  16  B.  17  C.  18  D.  19  E.  20

**B2 Quantitative Comparisons**

Choose A if column A is always larger. Choose B if column B is always larger. Choose C if the two columns are always equal. Choose D if you cannot determine which one is larger with the given information.

| Column A | Column B |
|----------|----------|



$$x\%$$
$$y\%$$
$$y\%$$
$$y\%$$
$$y\%$$
$$x\%$$

**2x% of the circle is shaded and 4y% is unshaded.**
$$x>30$$

9.
$$\dfrac{\dfrac{2}{3}}{\dfrac{3}{2}}$$

1

14.     y                                  10

10.  15% of 2000          2000% of 15

15.     $(3^x)^y$                          $3^x 3^y$

**x and y are integers and x>y>1**

11.    $x^y$                              $y^x$

**x and y are positive integers**



16.     $\dfrac{b}{a}$                              $\dfrac{d}{c}$

12.  Sum of the areas of triangles A and B above          $\dfrac{z^2}{2}$

13.  $x = \dfrac{2}{3}r$, $r = \dfrac{12}{15}y$, $y = \dfrac{5}{2}z$

x                                  4z
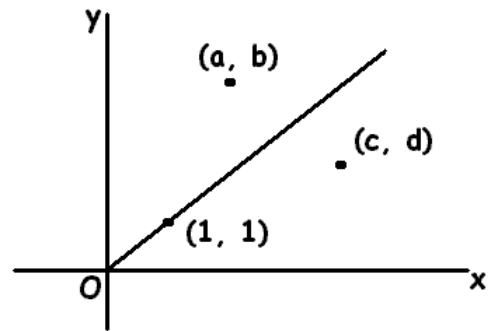
1.      Three pounds of candy at 60 cents per pound are mixed with one pound of candy worth 80 cents per pound.  What is the per pound cost of the mixture?
A. 48¢  B.  55¢  C.  65¢  D.  80¢  E.  90¢

2.      $\sqrt{4624}$
A.  61  B.  66  C.  68  D.  74  E.  82

3.      9654·468
A.  249143   B.  441685   C.  4532510
D.  4518072   E.  4831925

4.      Eight boys empty a truck in two hours.  How long will it take five boys?
A.  30 min  B.  1 hr. 40 min  C.  2 hr
D.  3 hr 12 min  E.  4 hr

5.      A tree cast a shadow of 9 ½ feet.  A four foot stick casts a shadow of 3 feet.  How tall is the tree?
A.  20 ft 6 in  B.  12 ft 8 in  C.  9 ¾ feet
D.  9 ft 6 in    E.  8 ft

6.  What is the sum of 7 hours 42 minutes and 3 hours 34 minutes?
A.  14 hours  B.  12 hrs 26 min
C.  11 hrs 16 min    D.  10 hrs 16 min
E.  10 hrs 8 min

7.      $\sqrt{5776}$
A.  64  B.  66  C.  73  D.  76  E.  84

8.      A man can run 4 miles in 1 hour.  After running for 2 ½ hours, he stops and walks back in 6 hours.  At what rate does he walk?
A.  7/8 mph    B.  1 2/3 mph  C.  2 mph
D.  2 ½ mph    E.  3 mph

9.      A woman bought a couch at a 40% reduction sale.  She paid $165.  What was the original price?
A.  $412    B.  $330   C.  $275
D.  $200    E.  $66

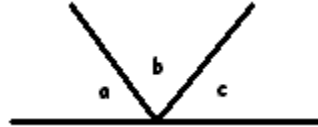10.     325% of 60 is
A.  15  B.  75  C.  120  D.  180  E.  195

11.  $\sqrt{4225}$
A.  58  B.  64  C.  65  D.  66  E.  75

12.  87,352 × 987 =
A.  94,434  B.  86,215,428   C.  86,205,418
D.  86,216,424   E.  92,347,015

13.  Angles a, b, and c are in the ratio of 4:5:6.  Find angle c



A.  12  B. 24  C.  48  D.  60  E.  72

14.     A pound of nuts costs $1.44.  How much would 6 ounces cost?
A.  92¢  B.  80¢  C.  72¢  D.  54¢  E.  14¢

15.  A carpenter does a job in 6 hours.  His helper does the same job in 8 hours. How long will the job take if they both work together?
A.      7 hr      B.      6 ½ hr    C.  4 hr
D.      3 ½ hr      E.   3 3/7 hr

16.     How long is the diagonal of a rectangle whose sides are 3 and 7?
A.  4  B.  6.6   C.  $\sqrt{39}$  D.   $\sqrt{58}$  E.   $\sqrt{101}$

17.     Columbian coffee at $8 per pound is mixed with Expresso coffee at $3 per pound.  How many pounds of Columbian coffee are needed to make 50 pounds of a blend which would cost $5 per pound?
A.  20  B.  25  C.  30  D.  35  E  40

18.     Five men do a job in 8 hours.  How long will it take 4 men to do the same job?
A.  4 ½   B.  5  C.  6  D.  10  E.  20

19.     A woman and her daughter do a job.  The woman working alone can do the job in 4 hours.  The daughter, working alone, takes 7 hours.  How many hours does the job take if the mother and the daughter work together?
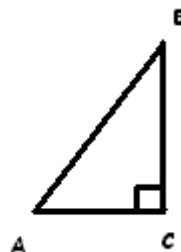A.  11  B  5 ½  C.  2 6/11  D.  2 ½  E.  2

20.     9+(.9+.009)=
A.  .9909    B.  .999   C.  9.909
D.  99.909   E.    999.09

21.     x+y=70 and x+y+z=66.  Find z
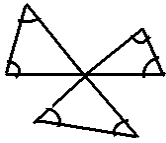A.  –136  B.  –74  C.  –4  D.  68  E.  136

22.     In a right triangle ABC (shown), AC=3, BC=5.  Find AB.
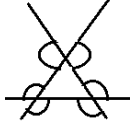


A.  4  B.  3$\sqrt{2}$   C.  5  D.  $\sqrt{34}$  E.  8
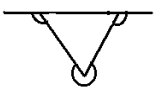
1) Find the sum of the marked angles.

A. 180  B. 360  C. 540  D. 720
E. Cannot be determined

2) Find the sum of the marked angles

A. 360  B. 540  C. 720  D. 900
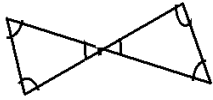E. Cannot be determined

3. Find the sum of the marked angles

A. 180  B. 270  C. 360
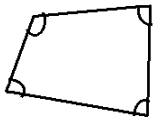D. 450  E. 540

4. Find the sum of the marked angles

A. 90  B. 180  C. 270
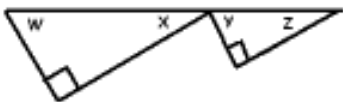D. 360  E. 720

5. Find the sum of the marked angles
A. 180  B. 270  C. 360
D. 540  E. 720

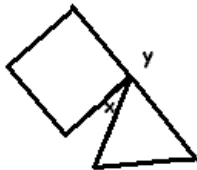6. What is the average of the measures of the marked angles

A 60  B 90  C 180  D 270  E 360

7. Find w+x+y+z
A. 90  B. 180  C. 270  D. 360
E. Cannot be determined

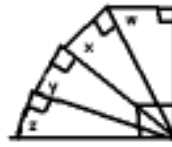8. A square and an equilateral triangle are placed as shown.
Find x+y
A. 90  B. 150  C. 210  D. 270
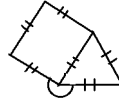E. Cannot be determined

9. AB=BD
∠A = 31
Find ∠BDC
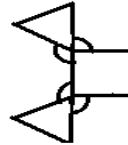
A. 8  B. 28  C. 31  D. 56  E. 118

10. Find w+x+y+z

A. 180  B. 210  C. 240
D. 270  E. 360

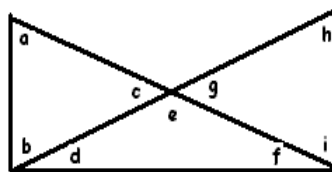11. A square is built on an equilateral triangle. Find the marked angle.
A. 360  B. 270  C. 210
D. 180  E. 150

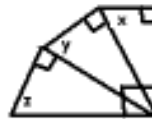12. A square and two equilateral triangles are arranged as shown. Find the measure of the marked angles.
A. 180  B. 210  C. 360
D. 420  E. 720

13.

Find a-e+b-f+c-d+g+h+i
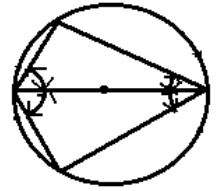A. 120  B. 135  C. 180  D. 540
E. cannot be determined

14. Find x+y+z

A. 120  B. 135  C. 180  D. 540
E. Cannot be determined

15. Find the average measure of the marked angles.

A. 45  B.60  C.72  D.90  E.360

16. Find the sum of the marked angles

A. 145  B. 180  C. 360  D. 400
E. Cannot be determined

17. Find the sum of the marked angles
A. 130  B. 230  C. 410
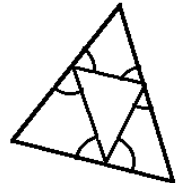D. 590  E. 720
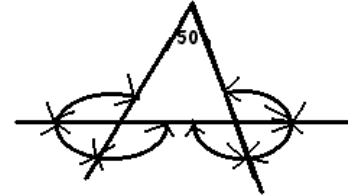
18. Find the average of the three marked angles
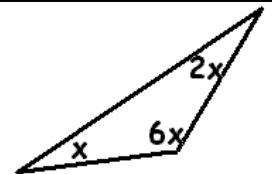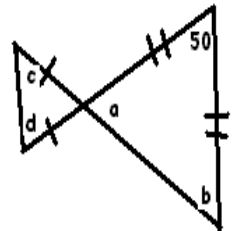A 45  B 60  C 90  D 180  E 360

19. Find the sum of the marked angles

A 180  B 270  C 360  D 450
E. Cannot be determined

20. What is the value of 6x?

A 20  B 40  C 60  D 90  E 120

21. Find a+b+c+d
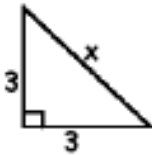
A 115  B 145  C 195
D 245  E 260
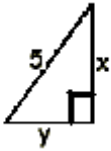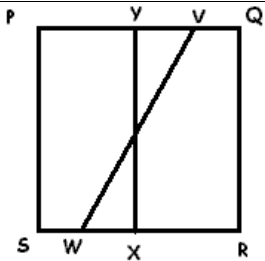
**E - Just Measure It**

| Column A | Column B |
|---|---|



1)    x                    5



y=2x

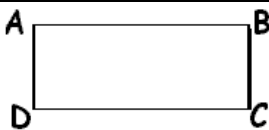2)    x                    3



Square PQRS

3) Length              Length of
   of SR                 VW



$AB=10$   $BC=\dfrac{2}{5}AB$

Rectangle ABCD

4)      Find BD (not drawn)

A. $\sqrt{89}$   B. $2\sqrt{29}$   C. $11\frac{1}{2}$

D. $\sqrt{161}$   E. 14
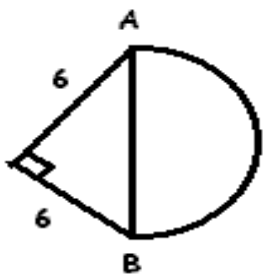


5)       What is the length of arc AB in the above semicircle?

A. $3\sqrt{2}$  B. $3\pi$  C. $3\pi\sqrt{2}$  D. $6\pi$  E. $36\pi$

---
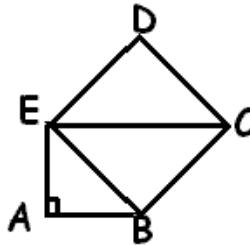


ΔABE is right.  EBCD is a square

6)    ΔABE                ΔEDC



7)  The length of the path of the semicircles is $6\pi$. Find the length of the line segment AB.

A. 6  B. $2\pi$  C. 12
D.  18  E. $18\pi$
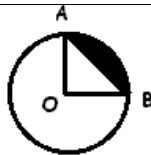


8)  O is the center.  AOB is a right triangle.  AB has length $6\sqrt{2}$.  Find the shaded area.

A.   $27\pi + 18$   B.   $27\pi - 18$
C.   $9\pi + 18$   D.   $9\pi - 18$
E.   Cannot be determined
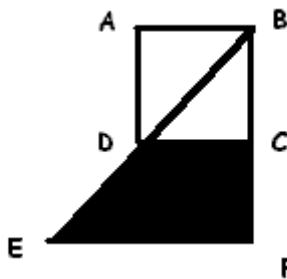


9) BEF is an isosceles right triangle. AB=1.  BE=2.  ABCD is a square. What is the area of the shaded region?

A.  2  B.  $\sqrt{2}$   C.  1
D. $\dfrac{\sqrt{2}}{2}$   E. $\dfrac{1}{2}$

---



10)     Three equal semi circles are drawn on the diameter of a circle with center O.  If the area of the circle is $9\pi$, then the area of the shaded region is

A. $\dfrac{7\pi}{3}$   B. $4\pi$  C. $\dfrac{9\pi}{2}$

D. $5\pi$   E. $\dfrac{11\pi}{2}$
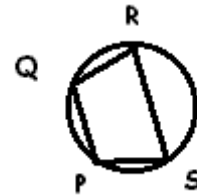


11)     The diameter of the circle is 1.
Perimeter                    4
of PQRS
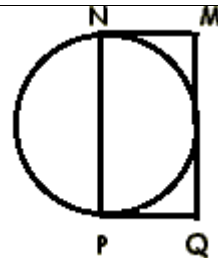


12.

| Circumference of circle with diameter NP | Perimeter of rectangle MNPQ |
|---|---|

**F - Right Triangle Theme Problems**

Column A          Column B
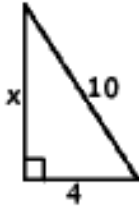


(1)     x                    9
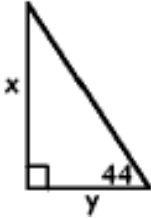


(2)     x                    y
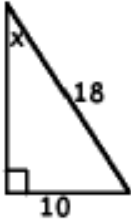


(3)     30°                  x
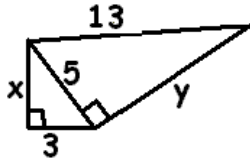


(4)     3x                   y
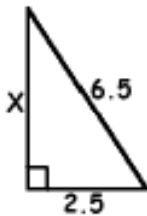


(5)     x                    5.5
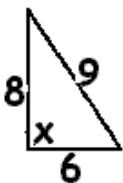


(6)     x°                   90°
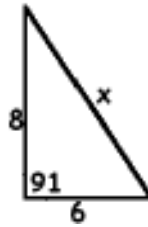


(7)     10                   x
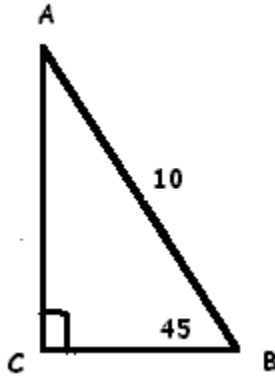


(8)     22        Perimeter of
                  △ABC
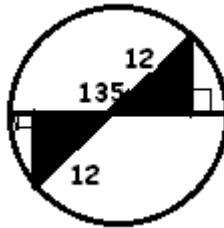


(9)      Radius of circle is 12.
Find area of shaded region.
A. 24  B.  72  C.  24π
D.  144        E.  144π
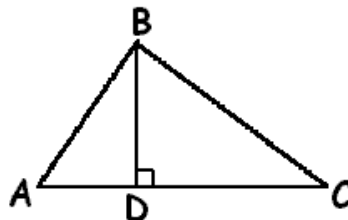


10.  BD = 12  AB = 13   BC=15
Find area of △ABC
A.  42  B.  63   C.  84
D.  105        E.  126

11.  Using the same figure as above, find the perimeter of △ABC.
A.  42    B.  54  C.  63
D.  84         E.  24+24π



(12) Perimeter        Perimeter
     △ABC             △DEF

G
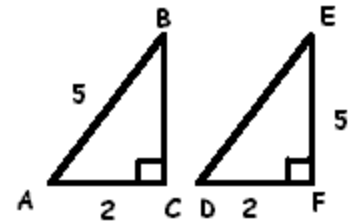
## Triple True False

1. If $\dfrac{x}{3} = x^2$

then x can be which of the following:

I. $\dfrac{-1}{3}$          A. I only

II. 0                 B. II only

III $\dfrac{1}{3}$           C. III only

              D. II and III only
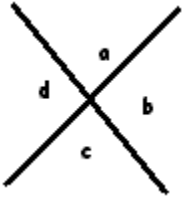
              E. I, II, and III



2. In this figure, which of the following must be equal to 1?

I. $\dfrac{a + b}{c + d}$   II. $\dfrac{ab}{cd}$   III. $\dfrac{c + d - a}{b}$

A. None      B. I only    C. II only
D. I and II  E. I, II, and III

3. w = 2x = 3y, then 5w is equal to which of the following?

I. 15y        II. 2x+12y   III. 4x+8y

A.     I only  B.  II only  C.  III only
D. I and II   E.     I and III

4. On a rectangular system, which of the following points would be the same distance from the origin as (2, 0)?

I (0,2) II (-2, 0) III. (1, 1)

A.     I only         B.     III only
C.     I and II only  D.     I and III only
E.     I, II, and III

5. Of 300 high school students in a gymnasium, which of the following must be true?

I.     At least 2 were born in the same year
II.    At least 2 have the same birthday
III.   At least 1 one born at midnight

A.     I only      B.     II only
C.     III only    D.     I and II only
E.     I, II, and III

6. If the product of two positive integers r and s is 7420, which of the following must be true?

I.     Both r and s are even
II.    Either r or s is a multiple of 10
III.   Either r or s is a multiple of 5

A.     None       B.     I only
C.     II only    D.     III only
E.     I, II, and III

7. If the sum of n consecutive integers is zero, which of the following must be true?

I.     The product of the n consecutive integers is zero.
II.    The average of n consecutive integers is zero.
III.   n is an odd number

A. I only      B. II only     C. III only
D. I and II   E. I, II, and III

## Odd Or Even

1. How many odd positive integers are less than 36?

A. 16.  B.  17  C.  18  D.  19  E  35

2. The sum of two consecutive positive integers is never divisible by

A. 2  B.  3  C.  5  D.  7  E.  9

3. If x is odd and y is even, which of the following could be an even integer?

A.     x+y   B.     $\dfrac{x}{2} + y$   C.     $\dfrac{x}{2} + \dfrac{y}{2}$

D.     x-y   E.  $x + \dfrac{y}{2}$

4. Which of the following must be even?

I.     The sum of two odd integers
II.    The sum of an odd and an even integer
III.   The sum of two even integers

A. I only    B. II only     C. I and II only
D. I and III only    E. I, II, and III

5. If $\dfrac{4}{N}$ is an odd integer, which of the following could be a value of N?

A. $\dfrac{4}{3}$  B. $\dfrac{5}{4}$  C. $\dfrac{3}{4}$  D. $\dfrac{2}{3}$  E. $\dfrac{1}{3}$

6. If n is an integer, which of the following will NEVER represent an even integer?

A. 2n  B. 2n+1  C. 3n+2  D 2(n-1)  E. $2(n + 1)^2$

7. Which of the following can be expressed as the product of two consecutive even numbers?

A.  24  B.  36  C.  42  D.  60  E.  72

1.    Ten people meet and everyone shakes hands exactly once with everyone else.  What is the total number of handshakes?
A.  9  B.  10  C.  45  D.  50  E.  100

2.    If eight people are standing on the circumference of a circle, what is the least number of people who must move so that all eight will be standing on a straight line?
A.  4  B.  5  C.  6  D.  7  E.  8

3.    X    Y        If x is a number from
      1    4        column X and y is a number
      2    5        from column Y, shown in the
      3    6        table, how many values are
                    possible for x+y?
A.  3  B.  5  C.  6  D.  9  E.  27

4.    In a kennel, there is a total of 25 dogs. 10 dogs have black spots.  12 dogs have brown spots, and 5 dogs have both black and brown spots.  What is the total number of dogs with neither black or brown spots?
A.  2  B.  3  C.  8  D.  13  E.  15

5.  How many different color combinations can three balls be painted if each ball is painted one color and there are three colors available? (Order is not considered: red, blue, red is considered the same as red, red, blue)
A.  4  B.  6  C.  9  D  10  E.  27

6.  There are 6 basketball teams in a league.  If six teams each play two games with each of the other teams, how many games will be played in the league?
A.  12  B.  15  C.  30  D.  36.  E.  60

7.    Three persons line up at a ticket window. In how many different orders can they arrange themselves in line?
A.  3  B.  4  C.  6  D.  9  E.  12

8.    At Central High School, the math club has 15 members and the chess club has 12 members. If a total of 13 students belong to only one of the two clubs, how many students belong to both clubs?
A.  2  B.  6  C.  7  D.  12  E.  14

9.    If a sports outfit consisting of a jacket, slacks, and hat can be made up from any 3 different jackets, 4 different pairs of slacks, and 2 different hats, then what is the total number of different outfits possible?

A.  4  B.  9  C.  12  D.  24  E.  36

10.    A high bouncing ball starts 36 feet up in the air and always bounces back half of the height of the last bounce.  How far will the ball have traveled when it hits the ground for the third time?
A.  9  B.  18  C.  36  D.  54  E.  90

I1

(1)
```
    5△2
   • 7
  ─────
  40□4
```

If △ and □ are different non-zero digits, then △ is

A. 8  B. 7  C. 3  D. 1
E. Cannot be determined

(2)
```
    □4
    3□
    □3
    5□
  + □1
  ─────
   15□
```

□ always represents the same number.  What must □ represent?

A. 9  B. 6  C. 4  D. 2
E.  Cannot be determined

(3)
```
       235
    •  4m7
  ────────
    1 6 4 5
    1 s 1 0
    9 4 0
  ──────────
   10y745
```

m, s, and y represent different digits.  What digit does s represent?
A. 9  B. 6  C. 4  D. 3
E. Cannot be determined

(4)
```
    4938
  + A3B4
  ───────
  12332
```

In the correctly done addition problem, what is the average of A and B.
A. 16  B. 9  C. 8  D. 7
E.  Cannot be determined

(5)
```
    AAA
  + AAA
  ──────
  1AA8
```

What is the value of A in the correctly done addition problem?
A. 9 B.  8  C. 7   D.  4
E. Cannot be determined

(6)
```
    1x3
    y3
  + z6
  ─────
   312
```

In the problem given, what could be digit z?
I.    1
II.   5
III.  8
A.  II only  B.  III only   C.  I and II only
D.  II and III only    E.  I, II, and III

(7)
```
    19
    ■O
  + ■■
  ─────
  103
```

In the correct addition problem, three digits have been blacked out.

| Column A | Column B |
| --- | --- |
| The sum of the three blacked out digits | 12 |

(8)  If $x + 9 = 2x + 6$ then $x + 8$
A.  –3  B.  3  C.  5  D.  8  E.  11

(9)  $5x - 8 = 7a$   What is $\dfrac{10x - 16}{a}$?

A.  14a  B.  $\dfrac{7a + 8}{5}$  C.  14  D.  2  E.  $\dfrac{1}{7}$

(10)  $x + 4 = 8$.  Which is NOT true
A.  2x = 8  B.  2x+4=16   C.  x+8=12
D.  $x^2 + 8x - 48 = 0$   E.  $x^2 = 16$

(11)  If $y + \dfrac{1}{y} = 9$ then $y^2 + \dfrac{1}{y^2} =$

A.  83  B.  81  C.  79  D.  3  E.  1/9

(12)  x+4 = 3x+10 then 2x
A.  12  B.  6  C.  0  D.  –6  E.  –12

(13)  What is the value of n if x+5 is a factor of $x^2 + nx + 10$?
A.  20  B.  7  C.  3  D.  2  E.  –7

(14)  If 3x+2y=11, what is the value of 9x+6y?
A.  99  B.  66  C.  33  D.  $30\dfrac{3}{11}$
E.  Cannot be determined.

I2

(15) If $a^2 + b^2 = 30$ and $ab = 6$, what is the value of $(a + b)^2$?
A. 936  B. 900  C. 42  D. 36  E. 6

---

(16) $x^2 + y^2 = 40$ and $(x - y)^2 = 10$ find xy.
A. 50  B. 25  C. 15  D. $5\sqrt{2}$
E. Cannot be determined

---

(17) $x^2 - y^2 = 90$ and x+y=10
What is x-y?
A. 900  B. 72  C. 90  D. 9  E. 3

---

(18) $x^3 + y^3 = 120$, x+y=6
What is $x^2 - xy + y^2$?
A. 216  B. 60  C. 36  D. 20  E. $\sqrt[3]{6}$

---

(19) If $(a + b)^2 = 20$ and $a^2 + b^2 = 16$, find ab
A. 320  B. 4  C. 3  D. 2  E. 0

---

(20) If x + y = 3 and x − y = 5, then
$x^2 + y^2 =$
A. 45  B. 17  C. 15  D. 8  E. 2

---

(21) If x+y = 6 and x-y = 10 then
$x^2 - y^2 =$
A. 256  B. 60  C. 16  D. 4  E. −16

---

(22) $\dfrac{4}{3}$ is not between

A. $\dfrac{1}{2}$ and $\dfrac{3}{2}$   B. $\dfrac{2}{3}$ and 1   C. 1 and 2

D. $\dfrac{5}{4}$ and $\dfrac{6}{4}$   E. $\dfrac{6}{7}$ and $\dfrac{7}{2}$

---

(23) Which fraction is greater than $\dfrac{1}{2}$?

A. $\dfrac{2}{5}$  B. $\dfrac{3}{8}$  C. $\dfrac{16}{33}$  D. $\dfrac{5}{9}$  E. $\dfrac{3}{7}$

---

(24) What is the fractional equivalent of .1%?

A. $\dfrac{1}{100}$  B. $\dfrac{1}{1000}$  C. $\dfrac{10}{100}$  D. $\dfrac{1}{10000}$  E. $\dfrac{1}{1}$

---

(25) Put these fractions in order from smallest to largest. $\dfrac{2}{3}, \dfrac{7}{11}, \dfrac{9}{13}$

A. $\dfrac{2}{3}, \dfrac{7}{11}, \dfrac{9}{13}$   B. $\dfrac{7}{11}, \dfrac{2}{3}, \dfrac{9}{13}$

C. $\dfrac{2}{3}, \dfrac{9}{13}, \dfrac{7}{11}$   D. $\dfrac{9}{13}, \dfrac{2}{3}, \dfrac{7}{11}$

E. $\dfrac{9}{13}, \dfrac{7}{11}, \dfrac{2}{3}$

---

(26) Which fraction is largest?

A. $\dfrac{7}{11}$  B. $\dfrac{9}{13}$  C. $\dfrac{6}{7}$  D. $\dfrac{4}{13}$  E. $\dfrac{9}{20}$

---

(27) If x is from A and y is from B, give the maximum value of $\dfrac{x}{y}$

A = {1, 3, 5, 7, 8}  B = {2, 4, 6, 8, 13}

A. $3\dfrac{12}{13}$  B. $12\dfrac{5}{6}$  C. 13  D. 4  E. $\dfrac{8}{13}$

---

(28) If x is from A and y is from B, give the largest possible difference between values of $\dfrac{x}{y}$.

A = {1, 3, 5, 7, 8}  B = {2, 4, 6, 8, 13}
A. $3\dfrac{12}{13}$  B. 6  C. $12\dfrac{5}{6}$  D. $\dfrac{12}{13}$  E. $\dfrac{8}{13}$

1. If x+3=6+3, then x+4=
A. 3  B. 4  C. 6  D. 10  E. 13

2. If x=5 then $(x + \frac{1}{3}) + (x - \frac{1}{3}) =$
A. $2\frac{1}{2}$  B. 5  C. $7\frac{1}{2}$  D. 10  E. $12\frac{1}{2}$

3. $3(2)^2 + n = 13$, then n=
A. $\frac{12}{13}$  B. $\frac{13}{12}$  C. 1  D. $\frac{13}{4}$  E. 12

4. (4000-3999)n+1=7; find n.
A. 0  B. 6  C. 7  D. 3992  E. 3993

5. 3t=9, then 2t+5 =
A. 14  B. 12  C. 11  D. 3  E. $\frac{5}{2}$

6. If $\frac{x}{6} = 1$, and $\frac{y}{5} = 1$, then x+2y=
A. 0  B. 6  C. 11  D. 13  E. 16

7. If x+1+x+2+x+3=1+2+3, then 3x=
A. –1  B. 0  C. $\frac{1}{3}$  D. 1  E. 3

8. If x+2+x+5=x+9 then 3x=
A. 2  B. 6  C. 11  D. 16  E. 21

9. If x+y=2 then x+y-4=
A. –2  B. 0  C. 2  D. 4  E 6

10. If x+y=4, then x+y+11=
A. 4  B. 7  C. 8  D. 15  E. 22

11. If x+y+6=11, which of the following could not be x and y?
A. x=3, y=2  B. x=1  y=4  C. x=-1 y=6
D. x=0, y=5  E. x=-2, y=-3

12. If x+y+3=10 then 2x+2y+6=
A. 12  B. 12  C. 16  D. 20  E. 26

13. If x+y+5=16 then 2x+2y+1=
A 20  B. 21  C. 22  D. 23  E. 24

14. If 3y-2=13 and x+y=4, x=
A. –1  B. $\frac{-1}{3}$  C. $\frac{1}{3}$  D. $\frac{23}{5}$  E. 9

15. What number is divisible by 2 and 3 but not by 5?
A. 900  B. 928  C. 951  D. 966  E. 999

16. Which number is divisible by 2 but not by 3 and not by 5?
A. 6  B. 10  C. 15  D 28  E 30

17. Which number is divisible by 3 and 4 but not by 5?
A. 660  B. 666  C. 668  D. 684  E. 685

18. Which number is even and divisible by both 9 and 5.
A. 27  B. 105  C. 135  D. 330  E. 540

19. n is a multiple of 4 and a divisor of 24. n could be
A. 2  B. 6  C. 8  D. 10  E. 20

20. The sum of m and p is 10. The difference of m and p is 2. Find m.
A. 2  B. 4  C. 6  D 8  E. 12

21. If x+y=6 and y+z=9, what is z?
A. 2  B. 3  C. 6  D. 7  E. cannot be
                           Determined

22. If 2x+3=15 and x+y=120, what is the value of y?
A. 6  B. 8  C. 60  D. 114  E. 135

23. If x-y=7 what is $x^2 - y^2$?
A. 0  B. 14  C. 49  D. 98  E. Cannot be
                                Determined

24. x and y are positive and $x^2 + y^2 = 13$ and x>y, x-y =
A. 1  B. 2  C. 3  D. 4  E. 5

25. If x=54 and y=27, which of the following is not a whole number?
A. $\frac{x+y}{3}$  B. $\frac{x+y}{9}$  C. $\frac{x+y}{18}$
D. $\frac{x+y}{27}$  E. $\frac{x+y}{81}$

26. If x=12 and y=15, which of the following is a whole number?
A. $\frac{x+y}{5}$  B. $\frac{y-x}{5}$  C. $\frac{x+y}{4}$
D. $\frac{x+y}{8}$  E. $\frac{x+y}{9}$

27 If A+2=4, then 2A+2=
A. 4  B. 6  C. 8  D. 10  E. 12

28. If 3A=12 and 4B=12 and 6C=12 then A+B+C=
A. 8  B. 9  C. 10  D. 11  E. 12

## K - Fake Operations



$$\frac{a \, b}{c} = \frac{a \bullet b}{c} + \frac{b \bullet c}{a} + \frac{c \bullet a}{b}$$

For non-zero a, b, and c.

1.



A. 1 B. 9 C. 10 D. 16 E. 26

2. If x ≠ 0,



A. $x^6 + x^4 + x^2$

B. $x^5 + x + \dfrac{1}{x}$

C. $x^4 + x^3 + 1$

D. $x^4 + x^2 + 1$

E. $x^2 + x + 1$

$$\frac{P}{\backslash} = \frac{p^2}{q^2}$$
$$Q$$

3.
3   5
\ · \   =
5   6

A. $\dfrac{1}{4}$  B. $\dfrac{1}{2}$  C. 2  D. 4  E. 8

4. Which of the following is not necessarily true?

I. P   Q
  \ = \
  Q   P

II. P   1/Q
  \ = \
  Q   1/P

III. P   R   PR
  \ · \ =  \
  Q   S   QS

A. I only  B. I, II only
C. I and III only
D. II and III only
E. I, II and III

---

5.  $7! = 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$

$7!_E = 6 \cdot 4 \cdot 2$

$7!_O = 7 \cdot 5 \cdot 3 \cdot 1$

Which of the following is true:

A. $\dfrac{7!_E}{7!_O} = 1$

B. $7!_E \bullet 7!_O = 7!$

C. $7!_E - 7!_O = 0$

D. $7!_E + 7!_O = 7!$

E. $7!_O < 7!_E$

---

6.



$= (n-4)^2$ for some positive integers n

Column A                Column B

            

7. x is an integer greater than 1.

 Denotes the smallest positive integer factor of x, not equal to 1.

    

---

8. For all real numbers P, Q

 $= 2PQ - (P+Q)$

 =

A. 2  B. 11  C. 31
D. 39  E. 49

---

9) Which of the following must be true (use above equation)?

I

 = 

II

 = 0

III

 $= 2P(P-1)$

A. I only
B. II only
C. III only
D. I, III only
E. I, II, III

---

10. For all integers x, y let xθy=3x+2y which of the following must be true?

I   3θ2=13

II  (0θ1) θ2= 0θ(1θ2)

III xθy=yθx

A. I only
B. II only
C. III only
D. I, III only
E. I, II, III

11.

 is defined to be $\dfrac{x-1}{y+1}$ where x and y are positive integers. Which of the following is least?

A. $\boxed{2,2}$    B. $\boxed{3,3}$

C. $\boxed{5,3}$    D. $\boxed{3,5}$

E. $\boxed{2,4}$

---

12. For any integer n define

 $=(n+1)n-(n-1)(n-2)$

 =

A. 18 B. 16 C. 14 D. 12 E. 10

13. Using above equation,

 =30,  So n=

A. 6 B. 7 C. 8 D. 9 E. 10

14.

 =ab+ac-bc.  Find x

 =0

A. 12 B. 7 C. 5 D. –7 E. -12

L - Quantitative Reasoning

A        if the quantity in column A is greater
B        if the quantity in column B is greater
C        if the two quantities are equal
D        if the relationship cannot be determined

|     | Column A | Column B |
| --- | --- | --- |
| 8.  | 0 | $0 \times 2$ |
| 9.  | $a + 25$ | $a - 5$ |
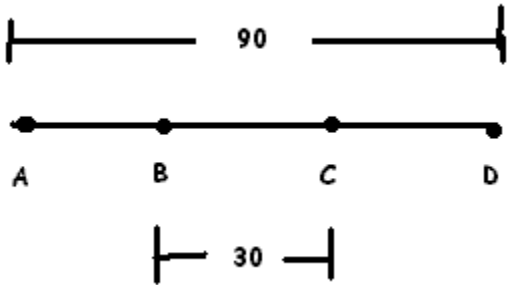


Note:  Figure not drawn to scale

| 10. | Length AC | Length BD |
| --- | --- | --- |

When a pitcher contains 3 cups of water, the pitcher contains half of its capacity

| 11. | The capacity, in cups, of the pitcher | 6 cups |
| --- | --- | --- |

| 12. | The cost of a stereo that is marked "15% off." | The cost of a television set that is marked "20% off" |
| --- | --- | --- |

$$x = -2$$
$$y = 1$$

| 13. | The value of $3y^2 - 2x$ | 0 |
| --- | --- | --- |

A triangle has angles with measures $x°$, $100°$, and $z°$

| 14. | 90 | $x$ |
| --- | --- | --- |

| 15. | $a(b+c)$ | $b+c$ |
| --- | --- | --- |

$$y = 2x + 3$$
$$x \geq 0$$

| 16. | $x$ | $y$ |
| --- | --- | --- |



m || n
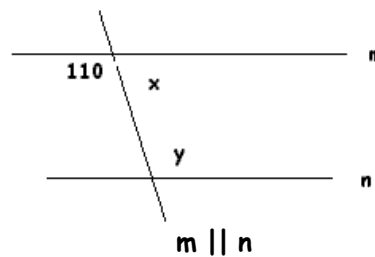
| 17. | $x+40$ | $y$ |
| --- | --- | --- |

-1, 0, 1, -1, 0, 1, …
The numbers -1, 0, 1 repeat in a sequence as shown

| 18. | The 34th number in the sequence | 0 |
| --- | --- | --- |

| 19. | The speed of one meter per second | A speed of 60 meters per hour |
| --- | --- | --- |
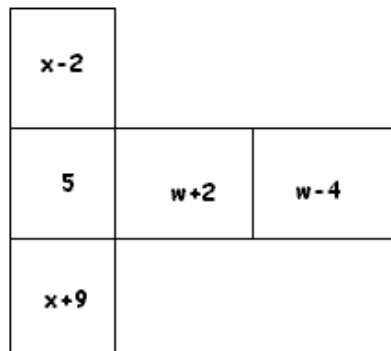


The sum of the three numbers in the column is equal to the sum of the three numbers in a row

| 20. | $x$ | $w$ |
| --- | --- | --- |

**M**

The ratio of Tina's weight to Rita's weight is 3:2.  The ratio of Rita's weight to Maria's weight is 1:2

| 21 | Tina's weight | Maria's weight |
|----|---------------|----------------|
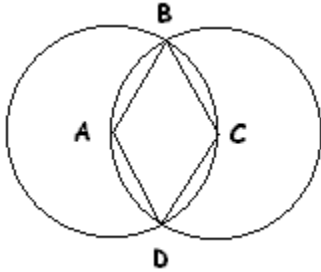


The two circles have centers A and C, respectively, and diameter of length x.  B and D are the points of intersection of the two circles.

| 22. | Perimeter of quadrilateral ABCD | 2x |
|-----|----------------------------------|-----|

$$y > 2x - 1$$
$$x > y$$

| 23. | x | 1 |
|-----|---|---|
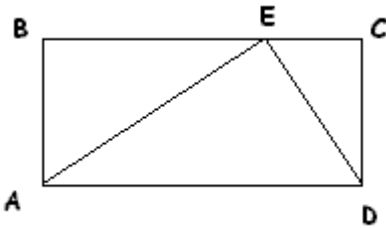


ABCD is a rectangle

| 24. | Perimeter of △ABE | Perimeter of △AED |
|-----|-------------------|-------------------|

2n+1 is a multiple of 3 and n is a positive integer less than 10
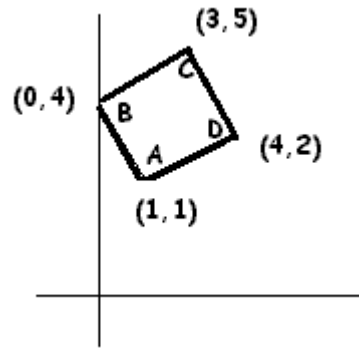
| 25 | n | 5 |
|----|---|---|



| 26. | Area of square ABCD | 10 |
|-----|---------------------|-----|

x is called a "perfect hypercube" if $x = y^4$ and y is a positive integer.

| 27. | The number of perfect hypercubes less than 1000 | 5 |
|-----|--------------------------------------------------|---|

# N - Quantitative Comparisons

Answer:  A if the quantity in Column A is greater
        B if the quantity in Column B is greater
        C if the two quantities are equal
        D if the relationship cannot be
           determined from the given information
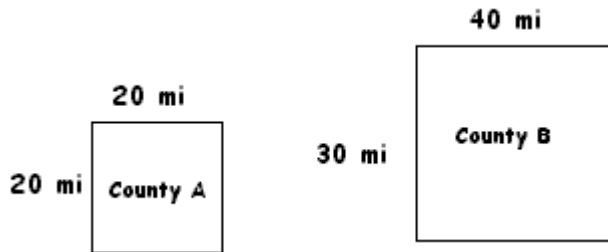
Counties A and B are rectangular

17.  Population of county     Population of county
     A if there are            B if there are 5
     10 people per          people per square
     square mile              mile

18.         $x$                        $2y$

19.      $\dfrac{0.35}{2}$           $\dfrac{1}{2} \cdot \dfrac{1}{3}$

Tom is now 5 years older than Bill was 3 years ago.  Bill is $x$ years old now.

20.    $x+8$         Tom's age now in years

In a certain game, there are only four types of moves.  These moves advance a playing piece 2, 3, 7, or 9 spaces, respectively, in any order.

21.     The minimum number of        4
       moves required to advance
       a piece exactly 26 spaces

$$2+y=6+y-4$$

22.         $y$                  $2$

23.     $\sqrt{x^4 + 4x^2 + 4}$      $x^2 + 2$

24.     $x+y+z$              $p+q+r+s$

$$n<1$$
$$n \neq 0$$
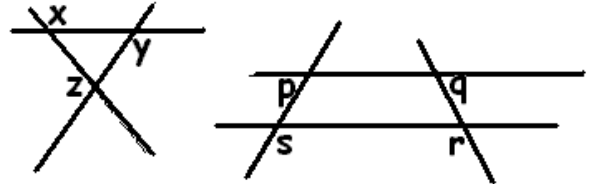
25.      $\dfrac{1}{n}$                 $n$

26.      $\dfrac{x^3}{3}$               $\left(\dfrac{x}{3}\right)^3$

| Machine-Part Production July 1 | | | |
|---|---|---|---|
| Company | Number not defective | Number defective | Defective as percent of total |
| A | 95 | 5 | 5% |
| B | 72 | X | 10% |
| C | 392 | Y | 2% |

27.            $x$                 $y$

## O - Simultaneous Equation Lesson

1.  For x, y
    $3x+2y=6$ and $2x+3y=10$.
    Find $x+y$.

A. 16  B. $\dfrac{18}{5}$  C. $\dfrac{16}{5}$  D. 3  E. $\dfrac{-2}{5}$

---

2,  If $x+y=8$ and $xy=15$
    then $x-y$ could equal

A. 2  B. 4  C. 6  D. 8  E. 9

---

| Column A | Column B |
| --- | --- |

3.  $x=24-y$
    $y-6=7$

| Column A | Column B |
| --- | --- |
| x | y |

4.  x and y are positive and $xy=2$

| Column A | Column B |
| --- | --- |
| $x+y$ | 3 |

5.  $9-3x=6$
    $12-2y=10$

| Column A | Column B |
| --- | --- |
| x | y |

6.  If $6t-p=8$ and $4t-3p=7$ then $t+p=$

A. $\dfrac{1}{2}$  B. 1  C. $\dfrac{17}{4}$  D. $\dfrac{27}{14}$  E. 3

---

7.  If $2a+3b=17$ and $a+2b=7$, find
    $\dfrac{3a+5b}{2}$

A. 10  B. 12  C. 18  D. 20  E. 24

---

8.  If $x^2-1=y$ and $x=3$ then $y^2=$

A. 81  B. 64  C. 9  D. 8  E. 4

---

| Column A | Column B |
| --- | --- |

9.  $x+y=8$ and $x-y=12$

| Column A | Column B |
| --- | --- |
| y | 0 |

---

10.  If $x+y=7$ and $3x-y=5$ and $2-y=r-1$, then what is the value of r?

A. –3  B. –1  C. 1  D. 2  E. 3

---

11.  If x is not 0 and $x=y$ and $\dfrac{3a}{x}=\dfrac{9b}{y}$ then

what is the value of a in terms of b?

A. $\dfrac{b}{3}$  B. b  C. 3b  D. 6b  E. 9b

---

| Column A | Column B |
| --- | --- |

12.  $\dfrac{3}{5}=\dfrac{x}{20}$

     and $\dfrac{4}{8}=\dfrac{y}{24}$

| Column A | Column B |
| --- | --- |
| x | y |

13.  $x+y+z=8$
     and $y=z$

| Column A | Column B |
| --- | --- |
| z | 4 |

---

14.  $x+y+z=6$ and $2y+z=7$
     If $z=1$ in the equations above, then $x=$

A. –1  B. 1  C. 2  D. 3  E. 5

1.    If 6 – x = 0, then 10 – x =
A.  16  B.  10  C.  6  D.  4  E.  0

2.    Joey buys a tennis racket and one can of tennis balls for $38.  Mary buys the same-priced racket and two cans of the same-priced tennis balls for $41.  How much does one of these rackets cost?
A.  $33  B.  $34  C.  $35  D. $36  E.  $37

3.    Kim was k years of age 2 years ago.  In terms of k, how old will Kim be 2 years from now?

A.  k+4  B.  k+2  C.  2k  D.  k  E.  $\dfrac{k}{2}$

4.  Club A has 10 members and Club B has 15.  If a total of 21 people belong to the two clubs, how many people belong to both clubs?
A.  3  B.  4  C.  5  D  6  E.  7
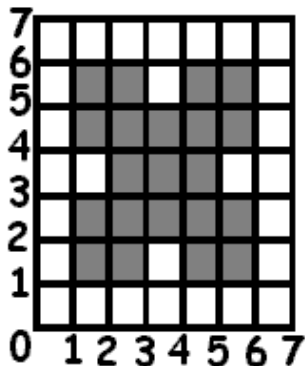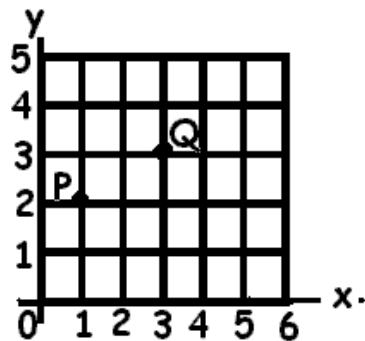


5.    In the figure above, what is the area of the shaded region?
A.  21  B.  24  C.  25  D.  28  E.  32

6.  If x-y=7, what is the value of $x^2 - y^2$?
A.  0  B.  14  C.  49  D.  98
E.  Cannot be determined from the given information

7.    If the product of the digits of a two-digit number is odd, then the sum of those digits must be
A.  Even  B.  Odd  D. Less than or equal to 5
D.  Greater than 5 and less than 10  E.  18



8.  If a right triangle is drawn on the grid above with PQ as the hypotenuse, which of the following could be the coordinates of the vertex of the right angle?
A.    (1,4)    B.    (2, 1)    C.    (2, 4)
D.    (3,1)    E.    (3,2)

9.  If $\sqrt{x}$ is a whole number, which of the following is NOT necessarily a whole number?

A.  $\dfrac{\sqrt{x}}{2}$  B.  x  C.  $x^2$  D.  $2\sqrt{x}$  E.  $x^3$

10.  The degree measures of the three angles of a triangle are p, q, and r, respectively.  If p is the average (arithmetic mean) of q and r, then p =
A.  30°  B.  45°  C.  60°  D.  90°  E.  120°



Questions 11 and 12 refer to the figure above in which A, B, C, and D represent four of the digits 1-9, inclusive, and A+B=10C+D



11.  In the figure above, what does C represent?
A.  1  B.  4  C.  6  D  8  E.  10

12.  Under the stated conditions, all of the following could be values of A + B EXCEPT
A.  12  B. 14  C.  16  D.  17  E.  22

1.     If $x - 7 = 5 - x$, then $x =$
A.  –6   B.  –1    C.   1   D.   6   E.   12

2.     A gymnast competed in a meet and received the following scores for three events:  9.5 for bars,  8.7 for balance beam, and 8.8 for floor routine.  What is the average (arithmetic mean) of these three scores?
A. 8.9   B.  9.0   C.  9.1   D.  9.2   E.  9.3

3.     On a number line, if a point P has coordinate –3 and point Q has coordinate 5, what is the length of segment PQ?
A.  2   B.  4   C.  5   D.  8   E.  64

4.   If $\dfrac{(20 + 50) + (30 + N)}{2} = 70$, then N=
A.  30   B.  40   C.  50   D.  60   E.  70
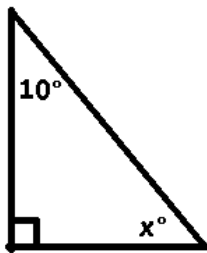


Figure not drawn to scale

5.     In the right triangle above, $x-10=$
A. 60   B. 70   C. 80   D. 90   E. 100

6.     If $(x + 3)^2 = (x - 3)^2$, then $x=$
A.  0   B.  1   C.  3   D.  6   E.  9

7.     Ms. Jones borrowed $1000 for a year. The cost of the loan was 6% of the amount borrowed, to be paid back together with the loan at the end of the year.  What was the total amount needed to pay off the loan?
A.  $1000.60    B.  $1006.00   C.  $1060.00
D.  $1600.00    E.  $6000.00

8.  If $\dfrac{5}{x} = 1$ and $\dfrac{y}{2} = 3$, then $\dfrac{3 + x}{y + 3} =$

A.  $\dfrac{5}{6}$   B.  $\dfrac{8}{9}$   C.  1   D.  $\dfrac{9}{8}$   E.  $\dfrac{6}{5}$

| Candidate | Number of Votes Required |
|-----------|--------------------------|
| A | 20 |
| B | 45 |
| C | 102 |
| D | X |
| E | Y |

9.     In a class of 300 students, 5 students were running for the position of student representative.  If every student in the class voted for exactly one candidate and the distribution of votes is given in the table above, what is the maximum possible value of x?
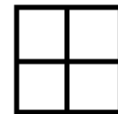A.  60   B.  133   C.  167   D.  233   E.  300

$$\lfloor x \rfloor = \dfrac{\sqrt{x}}{2}$$

for whole numbers x.

10.  Using the above, which of the following equals 5?

A  $\lfloor 10 \rfloor$          B  $\lfloor 20 \rfloor$          C  $\lfloor 25 \rfloor$

D  $\lfloor 50 \rfloor$          E  $\lfloor 100 \rfloor$

11.     To the nearest thousand, what is the number of seconds in a 24-hour day?
A.  8000   B.  9000   C.  86000
D.  87000   E.  90000



12.  The figure above is a square divided into four equal smaller squares.  If the perimeter of the large square is 1, then the perimeter of the small square is

A.  $\dfrac{1}{16}$   B.  $\dfrac{1}{8}$   C.  $\dfrac{1}{6}$   D.  $\dfrac{1}{4}$   E.  $\dfrac{1}{2}$

13.     If $\dfrac{5}{6} = \dfrac{x}{5}$, then $x=$

A.  $\dfrac{6}{25}$   B.  $\dfrac{6}{5}$   C.  $\dfrac{25}{6}$   D.  6   E.  25
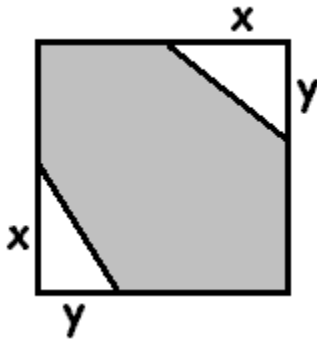
14.    P is the set of 8 consecutive integers whose sum is 12.  Q is the set of 6 consecutive integers whose sum is 9.  How many members of Q are members of P?
A.  None   B.  One    C.  Four
D.  Five    E.  Six

15.  Of the 60 people in a room, $\frac{2}{3}$ are women and $\frac{2}{5}$ are smokers.  What is the maximum number of women in the room who can be <u>nonsmokers</u>?
A. 16  B.  24  C.  34  D.  36  E.  40



16.  The square above has area $4x^2$.  If a rectangle with width x has the same area as the shaded region shown, what is the length of the rectangle in terms of x and y?
A.  x – y      B.  2x – y      C.  2x – 2y
D.  4x – 2y   E.  4x – y

17.    The average (arithmetic mean) age of Dave, Emily, and Frank is 12.  The average age of Dave and Emily is 11, and the average age of Emily and Frank is 10.  What is the average of Dave and Frank?
A.  10.5   B.  11  C.  12.5  D.  13  E.  15

18.  For all x,

$$\boxed{x} = 3x+1$$

Find x if

$$\boxed{2} - \boxed{x} = x$$

A.  1  B.  $1\frac{1}{2}$  C.  2  D.  $2\frac{1}{2}$  E.  3

19.  What is the ratio of the area of a rectangle with width w and length 2w to the area of an isosceles right triangle with hypotenuse of length w?
A.  $\frac{8}{1}$  B.  $\frac{4}{1}$  C.  $\frac{2}{1}$  D.  $\frac{1}{2}$  E.  $\frac{1}{4}$