

**MATHEMATICS - ALGEBRA**

1. For  $x=8$  , which of the following is the smallest ?

- A)  $\frac{7}{x-1}$   
B)  $\frac{x+1}{7}$   
C)  $\frac{x+1}{x-1}$   
D)  $\frac{7}{x+1}$

2. Abel and Paxton toss a coin: If the coin shows head, then Abel wins and Paxton has to give him 2 marbles. If the coin shows tail the winner is Paxton and Abel has to give him 3 marbles. After 30 games each of them has as many marbles as at the beginning of the game. How many times does Abel win ?

- A) 6  
B) 12  
C) 18  
D) 24

3. If  $x$  is the average of  $m$  and 9,  $y$  is the average of  $2m$  and 15 and  $z$  is the average of  $3m$  and 18, what is the average of  $x$  , $y$  and  $z$  in terms of  $m$  ?

- A)  $m+7$   
B)  $2m+3$   
C)  $m-7$   
D)  $2m+12$

4. Alvin can do a work in 14 days. Alvin and Brandon working together can do the same work in 10 days. In how many days can Brandon alone do the same work?

- A) 20  
B) 25  
C) 30  
D) 35

5. A bottle of lemonade consists of 6% of lemon juice. A bottle of strawberry juice consists of 14% pure strawberry. If we mix these two bottles of juice, what is the percentage of pure juice concentration?

- A) 10%
- B) 14%
- C) 6%
- D) 20%

6. A ball bounced 4 times, reaching two-thirds of its previous height with each bounce. After the fourth bounce, the ball reached a height of 48 cm. How high was the ball when it was dropped?

- A) 2 meter
- B) 1.62 meter
- C) 2.43 meter
- D) 2.06 meter

7. What is the value of x ?

$$\frac{x-2}{3} - \frac{x-2}{2} = -1$$

- A) 8
- B) -8
- C) 4
- D) -4

8. Ahmed and John are brothers. Ahmed is 4 years old and John is 13 years old. What age will each brother be when John is twice as old as Ahmed?

## NUMBER THEORY

9. How many digit 9's are there in this number  $10^{98} - 98$
- A) 98
  - B) 89
  - C) 100
  - D) 10
10. What is the last digit of this number  $98^9 - 8$ ?
- A) 0
  - B) 8
  - C) 6
  - D) 4

11. Mahmoud plays with numbers. He produces a sequence of positive integers by following two rules. He starts with a positive integer, then applies the appropriate rule to the result, and continues like this.

Rule 1: If the integer is less than 10, multiply it by 9.

Rule 2: If the integer is greater than 9, divide it by 2.

For example, 12,6,9,81,76,...

Find the 9<sup>th</sup> term of the sequence that begins 64,32,...

- A) 9
- B) 81
- C) 36
- D) 72

12.  $p$  and  $2p - 1$  are prime numbers. How many consecutive prime numbers  $p$  satisfying that condition?
- A) 3
  - B) 2
  - C) 1
  - D) 4

13. How many odd divisors does 22 have?

- A) 4
- B) 3
- C) 2
- D) 1

14. A teacher adds three different prime numbers and then he gets 16. What is the smallest prime that the teacher adds?

- A) 5
- B) 2
- C) 3
- D) 7

15. A and B are two different digits. What is the least possible 3-digit sum?

A	A	A
	B	A
+		A

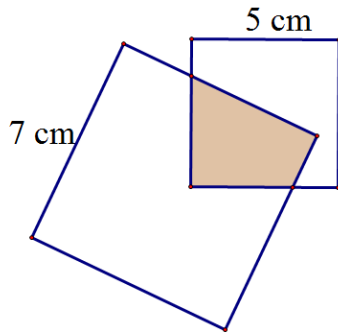
- A) A33
- B) A11
- C) B33
- D) B55

16. A man has a rectangular field whose sides are 25m and 60m long respectively. He wants to place trees around the field with maximum same distance between two trees is. What is the least number of trees that the man needs?

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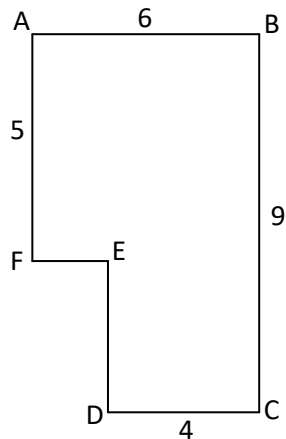
# GEOMETRY

17. Two squares of different sizes overlapped as shown in the given figure. What is the difference between non-overlapping areas?



- A)  $18 \text{ cm}^2$
- B)  $20 \text{ cm}^2$
- C)  $22 \text{ cm}^2$
- D)  $24 \text{ cm}^2$

18. What is the area of the polygon ABCDEF in square units?

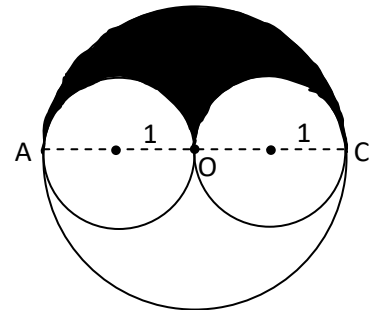


- A) 24
- B) 30
- C) 46
- D) 66

19. A square and a triangle have equal perimeters. The lengths of the three sides of the triangle are 6.2 cm, 8.3 cm and 9.5 cm. What is the area of the square?

- A)  $24 \text{ cm}^2$
- B)  $32 \text{ cm}^2$
- C)  $48 \text{ cm}^2$
- D)  $64 \text{ cm}^2$

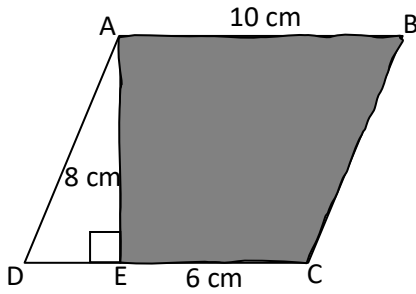
20. The large circle has diameter AC. The two small circles have their centers on AC and just touch at O, the center of the large circle. If each small circle has radius 1, what is the value of the ratio of the area of the shaded region to the area of one of the small circles?



- A) between a half and 1
- B) 1
- C) between 1 and 1.5
- D) cannot be determined from the information given

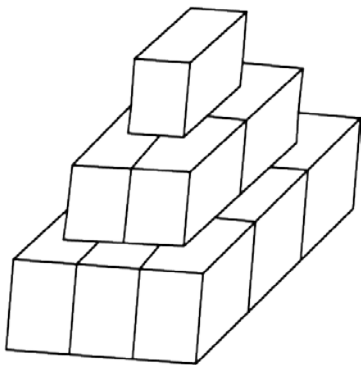
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21. What is the area of the shaded region ABCE in parallel ogram ABCD?



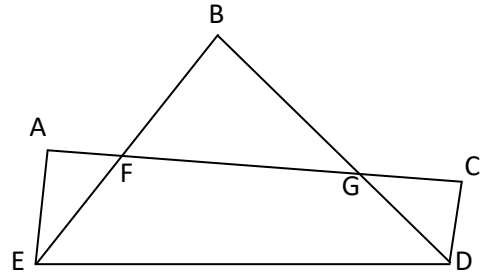
- A)  $80 \text{ cm}^2$
- B)  $64 \text{ cm}^2$
- C)  $48 \text{ cm}^2$
- D)  $24 \text{ cm}^2$

22. An artist has 14 cubes, each with an edge of 1 meter. He stands them on the ground to the form sculpture as shown. He paints the exposed surface of the sculpture. How many square meters does he paint?



- A) 21
- B) 25
- C) 33
- D) 37

23. In the figure, angle A, angle B and angle C are right angles. If  $\angle AEB = 40^\circ$  and  $\angle BED = \angle BDE$  What is the angle CDE?



- A)  $80^\circ$
- B)  $85^\circ$
- C)  $90^\circ$
- D)  $95^\circ$

24. A closed cylinder contains  $27\pi$  cubic centimeter of water and is filled to half of its capacity. When the cylinder is kept vertical on the circular base, the height of the water in the cylinder is 3 cm. If the cylinder is placed horizontally, what will be the height of the water level?

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## COMBINATORICS

25. I am a two-digit number whose digit in the tenth place is 1 less than twice the digit in the ones place. When the digit in the tenth place is divided by the digit in the ones place, the quotient is 1 and remainder is 4. What number am I?

- A) 63
- B) 72
- C) 84
- D) 95

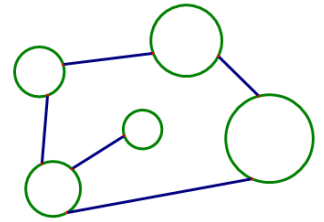
26. In a die, 1 and 6, 2 and 5, 3 and 4 appear on opposite faces. When 2 dice are thrown, product of the numbers appearing on the top and bottom faces of the 2 dice are formed as follows;

Number on top face of 1<sup>st</sup> die x number on top face of 2<sup>nd</sup> die  
 Number on top face of 1<sup>st</sup> die x number on bottom face of 2<sup>nd</sup> die  
 Number on bottom face of 1<sup>st</sup> die x number on top face of 2<sup>nd</sup> die  
 Number on bottom face of 1<sup>st</sup> die x number on bottom face of 2<sup>nd</sup> die

What is the sum of these 4 products?

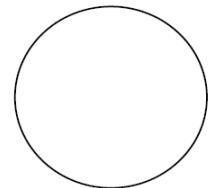
- A) 64
- B) 36
- C) 49
- D) 25

27. Five circles are connected as shown. Two different colors are available. Each circle is to be colored and no two adjacent connected circles can have the same color. How many different patterns of coloring the circles are possible?



- A) 2
- B) 8
- C) 3
- D) 5

28. Suppose in each day on a certain planet, there are only 8 hours and every hour has 30 minutes. What is the measure, in degrees, of the acute angle formed by the hour hand and minute hand at 2 o'clock?



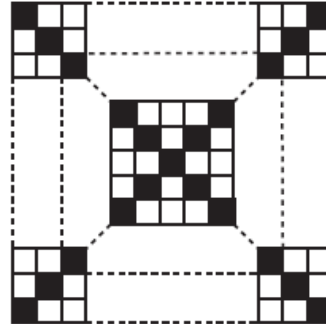
- A) 45
- B) 75
- C) 90
- D) 115

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29. How many integers can be expressed as a sum of three distinct integers chosen from the set  $\{5, 8, 11, 14\}$ ?
- A) 3
  - B) 4
  - C) 5
  - D) 6

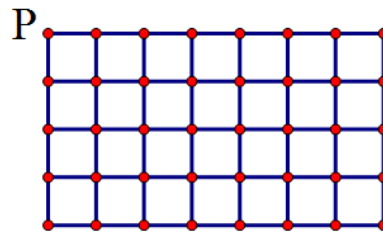
30. Construct a rectangle by putting together four squares with sides equal to 1, 1, 2, 3. What is the total area of the new rectangle?
- A) 14
  - B) 13
  - C) 15
  - D) 7

31. A square floor is tiled with congruent square tiles. The tiles on the two diagonals of the floor are black. The rest of the tiles are white. If there are 81 black tiles, what is the total number of white tiles?



- A) 1600
- B) 2500
- C) 2581
- D) 2000

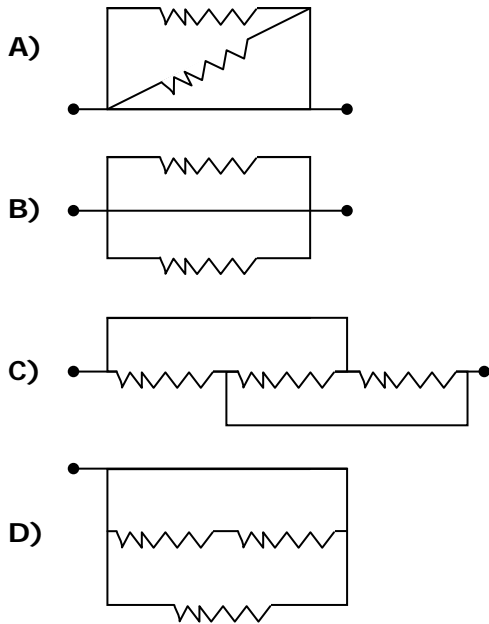
32. There are 40 grid points on the 4 by 7 grid diagram as shown, where the side of each small square is 1 cm. Starting from point P, an ant crawls from grid point to grid point along the grid lines, visiting each grid point exactly once before returning. What is the maximum length of its path, in cm?



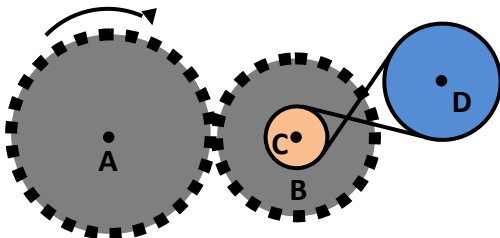


# SCIENCE - SAYANSI

1. Which one of the following networks does not have a short circuit?

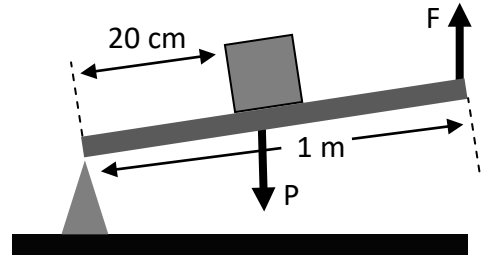


2. If gear A rotates three times in the direction shown in the figure, what will the direction and number of turns on wheel D be? (Number of teeth  $n_a=24$ ;  $n_b=18$  and  $R_D=2R_c$ )



- A) Clockwise, 1/2
- B) Clockwise, 2
- C) Anti-clockwise, 1/2
- D) Anti-clockwise, 2

3. The system shown in the figure is in equilibrium. What is the mechanical advantage of the lever shown in the figure? (P is the load)

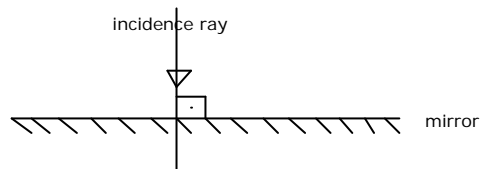


- A) 1/5
- B) 5
- C) 1/2
- D) 2

4. Which type of lense is used to treat myopia?

- A) Convex lense
- B) Plane lense
- C) Concave lense
- D) Biconvex Lense

5. If the incidence angle is  $90^\circ$ , what should the reflected angle be?



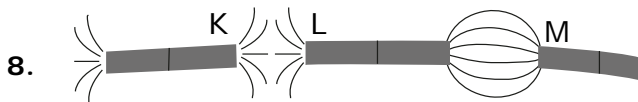
- A)  $0^\circ$
- B)  $90^\circ$
- C)  $180^\circ$
- D)  $270^\circ$

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6. What is the density of the mixture when we mix two liquids of densities  $d_1 = 0.4 \text{ g/cm}^3$  and  $d_2 = 0.8 \text{ g/cm}^3$ ? (The volume of the second liquid is twice that of the first)

7. As a candle burns in open air, it uses the gas called

- A) oxygen
- B) carbon dioxide
- C) nitrogen
- D) hydrogen

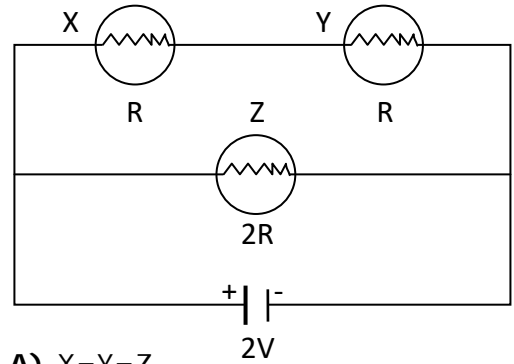


If the field lines of the magnets are as shown in the figure which one of the following may be correct for poles K, L and M?

- |      | <u>K</u> | <u>L</u> | <u>M</u> |
|------|----------|----------|----------|
| I.   | S        | S        | S        |
| II.  | N        | S        | N        |
| III. | N        | N        | S        |

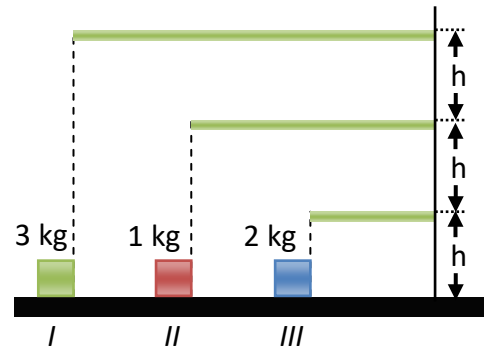
- A) I Only
- B) II Only
- C) I and II
- D) II and III

9. What is the relationship between the brightnesses of lamps X, Y and Z?



- A)  $X=Y=Z$
- B)  $X=Y>Z$
- C)  $Z>X=Y$
- D)  $Z>Y>X$

10. Three blocks are raised up to different heights as shown below. what will the relationship between work done on the objects?



- A)  $W_1 > W_2 > W_3$
- B)  $W_1 = W_2 = W_3$
- C)  $W_1 = W_2 > W_3$
- D)  $W_1 > W_2 = W_3$

11. At  $0^\circ \text{C}$ , water is.....

- A) Solid
- B) Liquid
- C) Solid + Liquid
- D) Liquid + Gas

12. Sugar dissolves in water, whereas naphthalene does not. In order to separate a sugar - naphthalene

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**mixture to obtain pure sugar, which of the following processes and in which sequence must be followed?**

- I. Evaporation**
- II. Dissolution in water**
- III. Filtration**

- A) III, II, I**
- B) II, III, I**
- C) I, III, II**
- D) II, I, III**

**13. Mushroom, yeast and penicillium are examples of**

- A) Non-green plants**
- B) Non-sporing plants**
- C) Pale green plants**
- D) Plants with weak roots**

**14. The washing away of top soil is termed as**

- A) soil conservation**
- B) soil prevention**
- C) soil erosion**
- D) soil profile**

**15. Water is taken in the plants through the roots by a process called**

- A) transpiration**
- B) osmosis**
- C) diffusion**
- D) photosynthesis**

**16. An example of egg laying mammal is**

- A) penguin**
- B) ostrich**
- C) whale**
- D) duckbilled platypus**

**17. The liver produces bile which is stored in the**

- A) pancreas**
- B) duodenum**
- C) pancreatic juice**
- D) gallbladder**

**18. Fruits which have tiny hooks are dispersal by**

- A) Animals**
- B) Wind**
- C) Self explosion**
- D) Water**

**19. A frog has\_ type of fertilization**

- A) Internal**
- B) External**
- C) Internal and external**
- D) Active**

**20. Culex mosquito causes**

- A) Elephantiasis**
- B) Malaria**
- C) Yellow fever**
- D) Measles**

**21. Platelets are cells formed in the blood. They**

- A) Fight germs causing diseases
- B) Help in clotting of blood
- C) Carry oxygen
- D) Carry carbon dioxide

22. **The heaviest organ in the human body is**

- A) The brain
- B) The liver
- C) The stomach
- D) The lungs