1. Which one is true?
   1.Similar triangles are congruent
   2.Congruent triangles are similar
   3.Similar triangles are equal in area
   4. All are correct
   Ans:2

2. The point of concurrency of altitudes of a triangle is called the
   1. Incentre 2. Circumcentre 3. Orthocenter 4. Centroid
   Ans : 3

3. The locus of a point equidistance from two parallel lines is a
   1. A parallel line

4. The polygon in which the sum of the interior angles is equal to the sum to the sum of the exterior angles is called a
   1. quadrilateral 2. pentagon 3. hexagon 4. heptagon

   Ans: 1

Explanation. The polygon in which the sum of the interior angles (360^o) is equal to the sum of the exterior angles (360^o) is called a quadrilateral, e.g., square, rectangle, rhombus, parallelogram and cyclic quadrilateral, kite, etc.

5. Two sides of a triangle are 6 cm and 8 cm. The length of the third side is
   1. 7 cm 2. 2 cm
   3. greater than 2 cm and less than 14 cm 4. Above 8 cm
   Ans: 3

Explanation
Properties of a triangle:
In triangle, sum of 2 sides must be greater the third side or the third side shall be less than sum of the other 2 sides; also the 3rd side shall be greater than the difference between these sides'
So, the third > 8 - 6 = 2 and also the third < 8 + 6 = 14.
So, the answer is 2 < third side < 14, i.e., the third side lies between(2 and 14).

6. If a+b+c=0, the value of $a^3 + b^3 + c^3$ is
   1. abc 2.3abc 3. $a^2b^2c^2$ 4.None

   Ans: 2

7. If $2^{2x-y} = 16$ and $2^{x+y} = 32$ the value xy is
   1.1 2. 4 3. 6 4. None
   Ans:3

Explantion

Given: $2^{2x-y} = 2^4$ and $2^{x+y} = 2^5$

$\therefore$ 2x-y = 4 and x +y = 5

$\therefore$3x = 9

x = 3 and y=2

$\therefore$ xy =6

8. A tank 10m x 5m x 6m is full of water. How much water must be taken out to reduce the water level by 1 m?

1. 30 m^3 2. 50 m^3 3. 60 m^3 4. 100 m^3

Ans:2

Explanation

Volume of full tank, V = lbh = 10x5x6 = 300m^3

Volume of water of 1 m depth = 10 x 5x1 = 50m^3

OR

Volume of water left after draining water by 1m (now the water height becomes 5 m)

= $300\times\frac{5}{6}$ m^3= 250m^3.$\therefore$ Volume of water to be reduced = 300 – 250 = 50

9. Which one of the following is a rational number?

1. Euilor number 2. π 3. 2.1387269 4. none of these

Ans: 4. (Euler number = 2.71828)

General Formula of Euler's Number

e is mathematically represented and defined by the following equation:

$$e = \lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n$$

https://www.cuemath.com/numbers/eulers-number/

10.. The dimensions of a brick are 24cm x 12 cm x 8 cm. How many bricks will be required to build a wall 24m x 8m x 6m if 20% of the wall is filled with cement mortar?

1. 40000 2. 47000 3. 51000 4. 55000

Ans: 1

Explanation

From the given condition, bricks make up 80% of volume of the wall.

$\therefore$ Number of bricks $= \frac{\text{Volume of wall without cement}}{\text{Volume of one brick}}$

$= \frac{80}{100} \times \frac{2400 \times 800 \times 600}{24 \times 12 \times 8} = 40000$

11. The number of subsets of a set of n elements is

1.n 2. 2n 3. 2^n 4. n^n

Ans: 3

12. Which of the following is not possible?

1. $\sin\theta = 1, \cos\theta = 0$
2. $\sin\theta = 0, \cos\theta = 1$
3. $\sin\theta = 1/\sqrt{2}, \cos\theta = 1/\sqrt{2}$
4. $\sin\theta = 1, \cos\theta = 0.5$

Ans: 4

Explanation

Option 1 is possible if $\theta = 90°$

Option 2 is possible if $\theta = 0°$

Option 3 is possible if $\theta = 45°$

Option 4 is not compatible

13. The area of a rhombus is 2016 cm^2 and its side is 65 cm. Its diagonals are

1. 63cm, 64cm 2. 61cm, 68cm 3. 63cm, 71cm 4. none of these

Ans: 1 (derived from answer)

Explanation

Option 1

Area, $A = ah = \frac{1}{2} . d_1 \times d_2$

$2016 = 65 \times h$ ……..(1)

$2016 = \frac{1}{2} . d_1 \times d_2$ …….(2)

There are two equations and 3 unknowns (i.e., h, d_1 and d_2). Hence, the diagonals cannot be determined from mathematical principles.

Option 2

Area, $A = \frac{1}{2} . d_1 \times d_2$ and therefore, from the given options, option 1 is the right answer.

14. In a group of 500 people, 200 can speak Tamiz only while only 125 can speak English only. The number of people who can speak both Tamiz and English are

1.175 2. 325 3. 300 4. 375

Ans : 1

Explanation

$A \cup B = \in A + \in B - A \cap B$

$500 = 200 + 125 - A \cap B$

$\therefore A \cap B = 175$. Operation through Venn diagram is shown below:

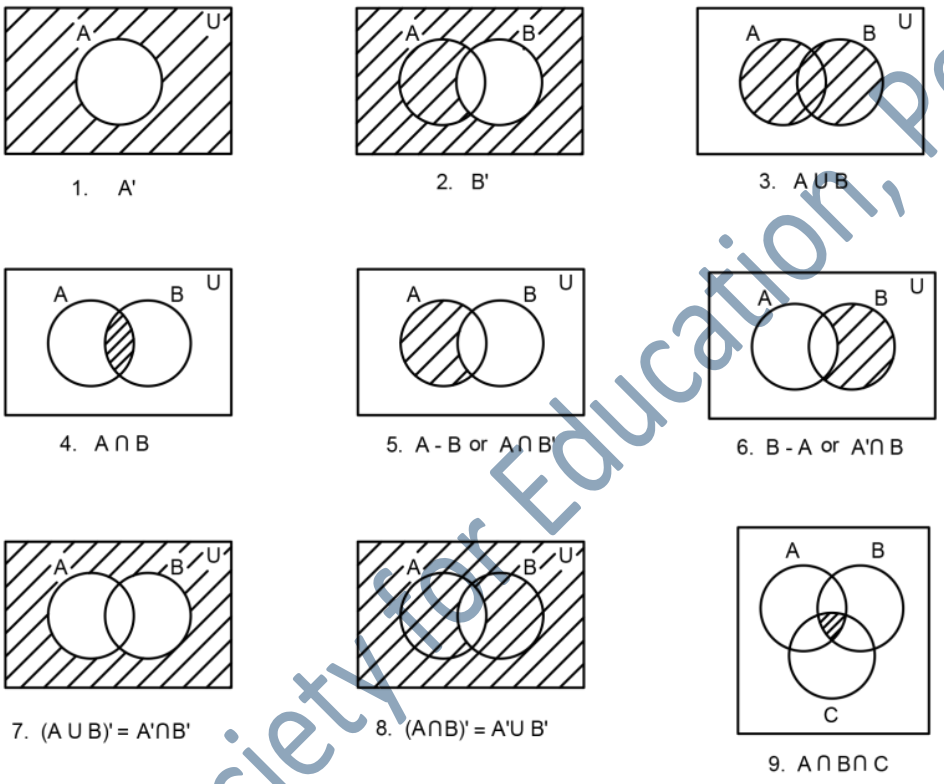


Figure : Sets - Few basic illustrations.(In the above cases, hatched area pertains to the under consideration mathematics).

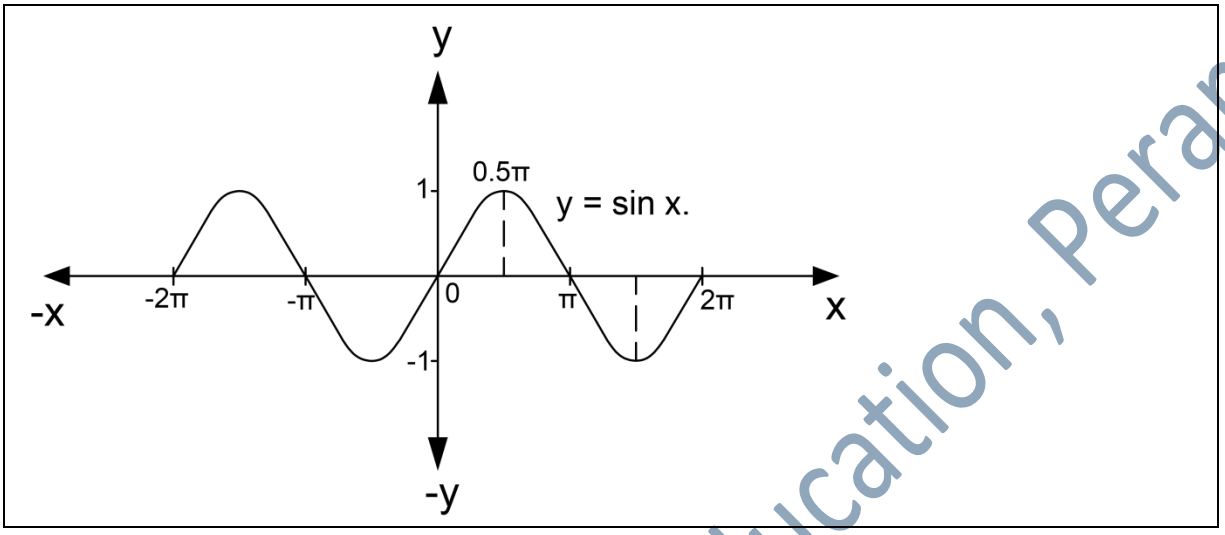
Formula

1. $n(A \cap B) = n(A) + n(B) - n(A \cap B)$
2. $(A \cup B)' = A' \cap B'$
3. $(A \cap B)' = A' \cup B'$
4. $A - (B \cup C) = (A - B) \cap (A - C)$
5. $A - (B \cap C) = (A - B) \cup (A - C)$
6. $n(A \cup B \cup C) = n(A) + n(B) + n(C) - (A \cap B)$
   $n(B \cap C) - n(C \cap A) + n(A \cap B \cap C)$

15. What is the maximum value of sin θ?

1. $\sqrt{3}$ 2. 3 3. 1 4. not defined

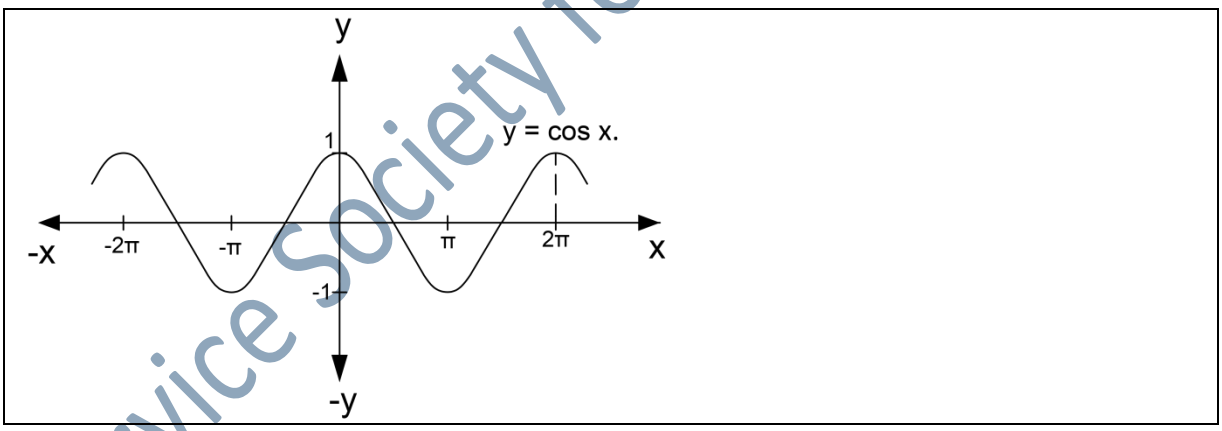
Ans: 3



16. What is the maximum value of cos θ?

2. $\sqrt{3}$ 2. 3 3. 1 4. not defined

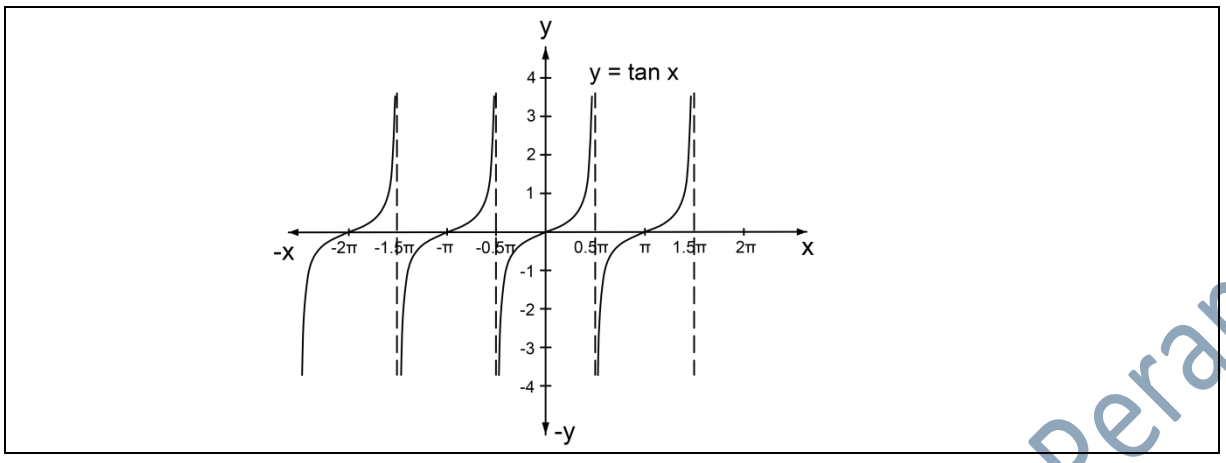
Ans: 3



17.. What is the maximum value of tan θ?

1. $\sqrt{3}$ 2. 3 3. 1/3 4. not defined

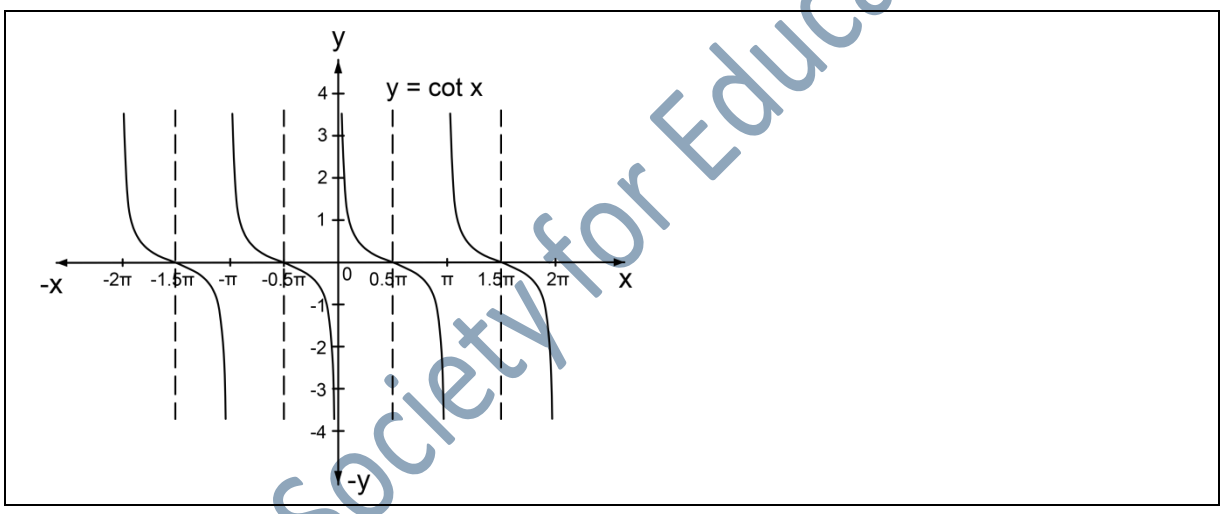
Ans: 4



18. What is the minimum value of cot θ?

1. -1 2. $-\sqrt{3}$ 3. -3 4. not defined

Ans:4



19.The graph of y = sin θ passes through

1. (0,0) 2. (0,1) 3. (1, 0) 4. None s

Ans: 1

20. The graph of y = cos θ passes through

1. (1,0) 2. (0,1) 3. (0,0) 4. (1,1)

Ans:2

21. The graph of y = tan θ passes through

1. (0,1) 2. (1, 0) 3. $(\pi/6, 0)$ 4. $(-\pi/2, \pi/2)$

Ans:4

Explanation
i. One cycle occurs between $-\pi/2$ and $\pi/2$.
ii. There are vertical asymptotes at each end of the cycle. The asymptote that occurs at $-\pi/2$ or $\pi/2$ repeats every π units.
iii. period: π
iv. amplitude: not defined.

22. If sin x = cos y, x + y is equal to

1. 30^o 2. 45^o 3. 60^o 4. 90^o

Ans:4

Explanation
Only θ = 45° satisfies the given condition: sin x = cosx.

23. $F(x) = \sin x + \cos x$, The maximum value of F(x) is

1. 1 2. $\sqrt{2}$ 3. $\sqrt{3}$ 4. 0

Ans:2

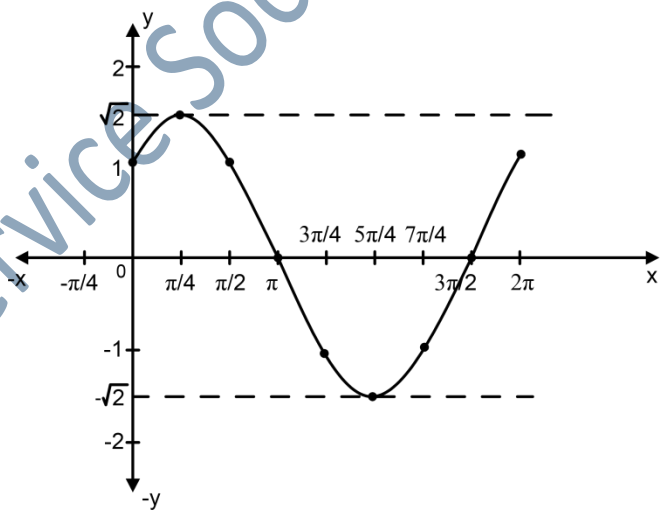
Explanation
For x = 0, F(x) = 0+1 = 1

x = 30°, $F(x) = \frac{1}{2} + \frac{\sqrt{3}}{2} = \frac{1+\sqrt{3}}{2} = 1.366$

x = 45°, $F(x) = \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} = \sqrt{2} = 1.414$

x = 60°, $F(x) = \frac{\sqrt{3}}{2} + \frac{1}{2} = \frac{1+\sqrt{3}}{2} = 1.366$

x = 90°, F(x) = 1+ 0 = 1



24. In the first quadrant, which one of the following is true?

1. cosθ increases when θ increases.
2. cosθ decreases when θ increases

3. cosθ remains constant
4. None

Ans: 2

Explanation

cos θ decreases from 1 to 0.

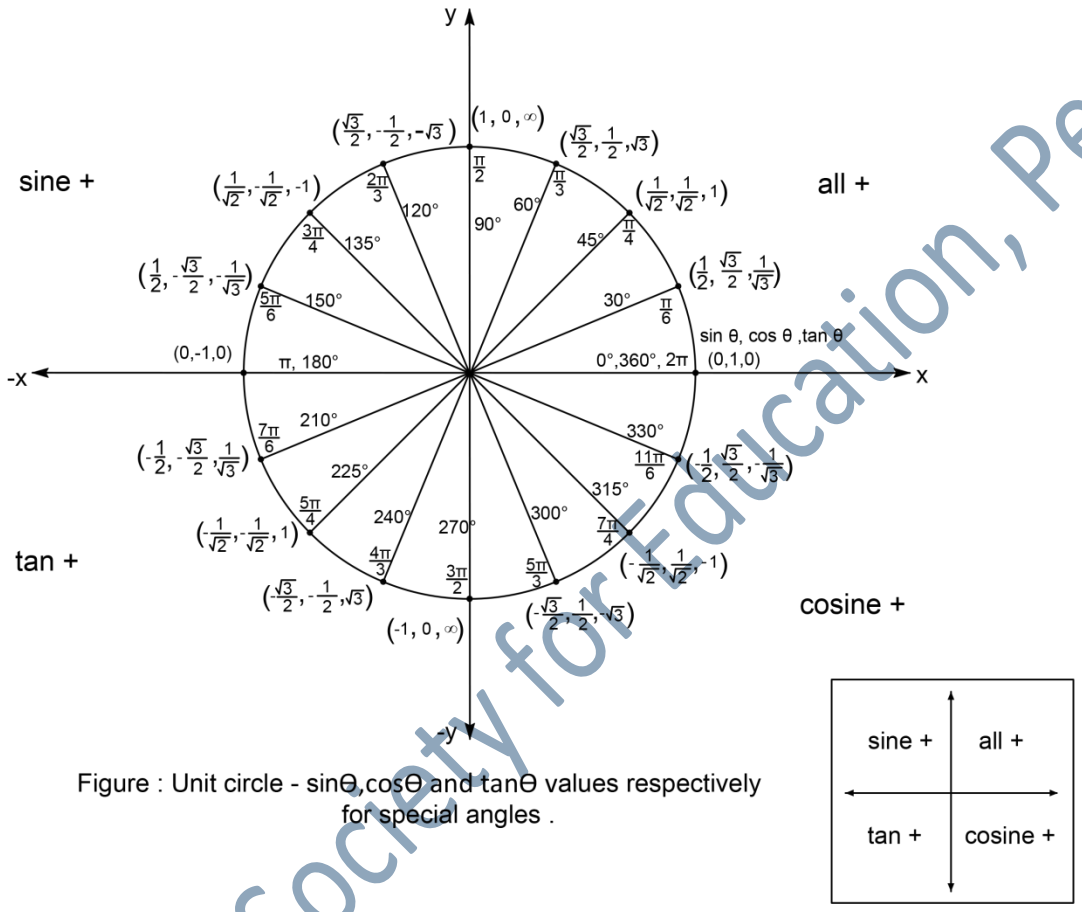


Figure : Unit circle - sinΘ,cosΘ and tanΘ values respectively for special angles .

25. In the first quadrant, which one of the following is true?

1. sin θ increases when θ increases
2. sin θ decreases when θ increases
3. sin θ remains constant
4. None

Ans: 1

Explanation

sin θ increases from 0 to 1. Refer to a Figure in the sum Qn. 25.

26. The lengths of the diagonals of rhombus are 8 cm and 6 cm. The height of the rhombus is

1. 4.5cm 2. 4.9 cm 3. 4.8 cm 4. 4.9 cm

Ans: 3

Explanation

Area, A = ah = $\frac{1}{2}$ d_1. d_2 = $\frac{1}{2}$ x 8x 6 = 24

a = $\sqrt{\frac{d_1^2}{2} + \frac{d_2^2}{2}} = 5$

∴A= ah = 5h = 24→ h = 4.8

27. The height of an equilateral triangle whose side is $20\sqrt{3}$ cm is

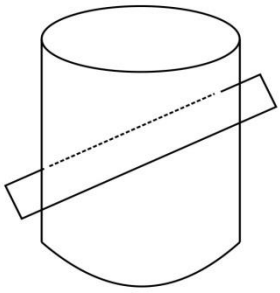
1. 20cm 2. 30cm 3. 32.5cm 4.None

Ans: 2

Explanation

h = $\frac{a\sqrt{3}}{2} = \frac{20\sqrt{3}\sqrt{3}}{2} = \frac{60}{2} = 30$

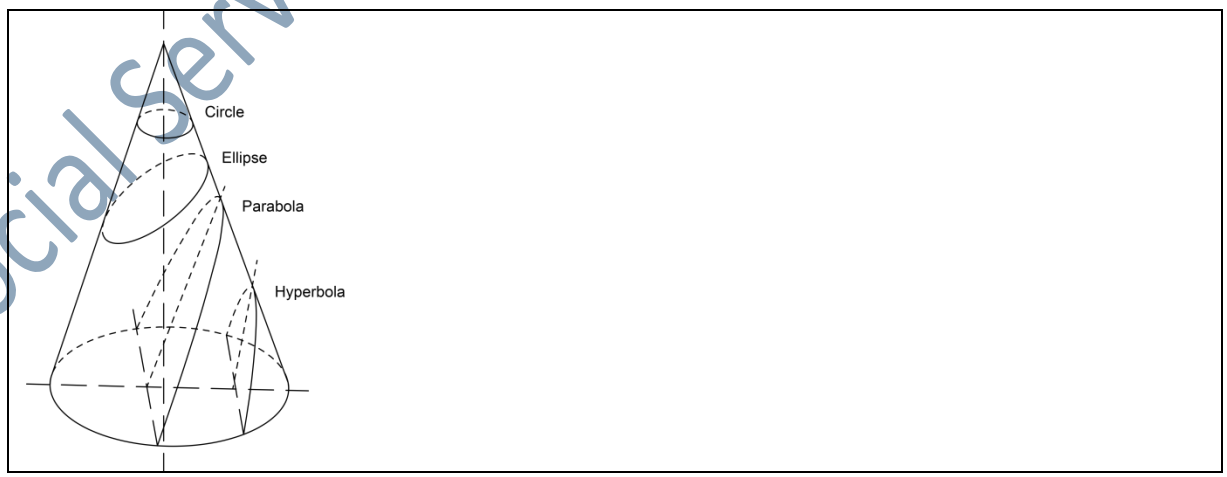
28. The solid cylinder is cut by an oblique plane as shown. The cut surface will assume the shape of:

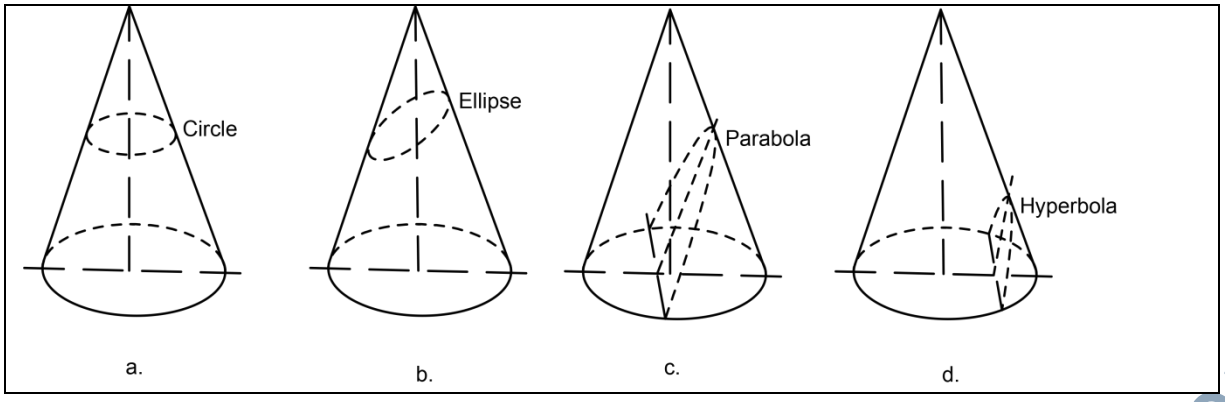


1) an ellipse 2) a circle 3) a parabola 4) none of these

Ans: a. Refer to conic sections below.

Box:Conic sections





29. $(1^0 + 2^0 + 3^0)$ is equal to

1) 0 2)1 3)3 4)6

Ans: 3 (Note: The given sum is 1 + 1 + 1 = 3)

27. A wire of length 25 cm is bent so as to lie along the arc of a circle of circumference 100 cm. The angle subtended at the center by the arc is

1. π 2. $\pi/2$ 3. $\pi/4$ 4. $\pi/3$

Ans: 2

100 cm circumference subtends 360^o
$\therefore$ 25 cm arc will subtend 90^o

30. The equation $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is true if

1. x =a tan θ, y = b cot θ
2. x = a sec θ, y = b cosec θ
3. x = a cos θ, y = b sin θ
4. x = 1/a y = 1/b
5.

Ans:3

Explanation

Determine $\frac{x^2}{a^2} + \frac{y^2}{b^2}$ for all options:

Option (1) $\rightarrow \tan^2\theta + \cot^2\theta \neq 1$ for most of the values of θ

Option (2) $\rightarrow \sec^2\theta + \text{cosec}^2\theta \neq 1$

Option (3) $\rightarrow \sin^2\theta + \cos^2\theta = 1$

Option (4) $\rightarrow 1+1=2$

Option 3 only satisfies the given condition.

31. The side of an equilateral triangle whose height is $20\sqrt{3}$ cm is

1. 27.5 cm 2. 30cm 3. 32.5cm 4. 40

Ans: 4

Explanation:

$a = \frac{2h}{\sqrt{3}} = \frac{2 \times 20\sqrt{3}}{\sqrt{3}} = 40$

32. The ratio of the area of a square to that of the square drawn on its diagonal is

1. 1:1.5 2. 1:2 3. 1:3 4. None

Ans:2

Explanation

Let side be a.

∴ Diagonal $d = a\sqrt{2}$

Let, the area of square of side a, $A_1 = a^2$

Area of square with diagonal as its side($d = a\sqrt{2}$), $A_2 = (a\sqrt{2})^2 = 2a^2$

∴ $A_1 : A_2 = 1:2$

33.. If one edge of a cuboid is increased by 50% and one decreased by 50%, its volume will

1. not change 2. increased
3. decreased 4. None

Ans:3

Explanation

A cuboid has 3 sides and its sides are l, b and h

For the given conditions, sides of cuboid become 1.5l, 0.5b, h

Original volume V = lbh

∴New volume V= 0.75lbh (i.e., the new volume is reduced from the original value by 25%)

34. If every side of a cuboid of surface area K is doubled, the surface area of the new cuboid will be

1. 2K 2. 4K 3. K^2 4. None

Ans: 2 (Volume will increase by 8 times)

Explanation

Let the sides be l, b and h. The sides are doubled so that l→ 2l, b→2b and h→2h

The original surface area, S =(lb+bh+lh) =K

Revised surface area= 4(lb+bh+lh) = 4K

36 The mean/average of the first n natural numbers is

1. $\frac{n}{2}$ 2. $\frac{n+1}{2}$ 3. $\frac{n}{2} + 1$ 4. $\frac{n^2+n+1}{2n}$

Ans: 2.

Explanation

The sum of first n natural numbers = $\frac{n(n+1)}{2}$

∴ Their average = $\frac{n(n+1)}{2} \div n = \frac{(n+1)}{2}$

35. The mean/average of the squares of the first n natural numbers is

1. $n + 1$ 2. $\frac{n^4+1}{n}$ 3. $\frac{(n+1)(2n+1)}{6}$ 4. $\frac{n(n+1)\ (n+2)}{n}$

Ans: 3.

Explanation

The sum of squares of the first n natural numbers = $\frac{n(n+1)(n+2)}{6}$

∴ Their average = $\frac{n(n+1)(n+2)}{6} \div n = \frac{(n+1)(n+2)}{6}$

35. The mean/average of the cubes of the first n natural number is

1. $\frac{n(n+1)^2}{4}$ 2. n^2 3. $\frac{n(n+1)(n+2)}{8}$ 4. None

Ans: 1.

Explanation

The sum of cubes of the first n natural numbers = $\frac{[n(n+1)]^2}{4}$

∴ Their average $= \frac{[n(n+1)]^2}{4} \div n = \frac{n(n+1)^2}{4}$

37. Which of the following is not possible?

a. $\sin\theta = 1, \cos\theta = 0$
b. $\sin\theta = 0, \cos\theta = 1$
c. $\sin\theta = 1/\sqrt{2}, \cos\theta = 1/\sqrt{2}$
d. $\sin\theta = 1, \cos\theta = {}^1/_2$

Ans: 4

Explanation

Option 1 is possible if $\theta = 90°$
Option 2 is possible if $\theta = 0°$
Option 3 is possible if $\theta = 45°$
Option 4 is not compatible

38. The circumference of a circle is 200 cm. The side of square inscribed in the circle is

1. $\frac{100\sqrt{2}}{\pi}$ 2. $\frac{50\sqrt{2}}{\pi}$ 3. $\frac{50}{\sqrt{2}}\sqrt{\pi}$ cm 4. None

Ans: 1

Explanation

Circumference = $\pi d = 2\pi r$
Given: $\pi d = 200 \rightarrow d = 200/\pi$

For a sqare inscribed inside a circle, the diagonal d_s is equal to the diameter of the circle, d. and hence the side of the square a, is $d/\sqrt{2}$

Square side, a $= \frac{200/\pi}{\sqrt{2}} = \frac{200}{\pi\sqrt{2}} = \frac{200 \times \sqrt{2}}{\pi\sqrt{2}.\sqrt{2}} = \frac{100 \times \sqrt{2}}{\pi}$

39. The sides of three faces of a cuboid are in the ratio 1:2:3. If its volume is 6000 cm^3, the length of the shortest side is

1. 7.5 cm 2. 10cm 3. 15 cm 4. 17.5 cm

Ans: 2

Explantion

Let the sides be l, b and h. ∴Volume of cuboid, V =lbh

For the given sides, V =a x 2a x 3a = $6a^3$= 6000

$6a^3 = 6000 \rightarrow a^3 = 1000 \therefore a = 10$

40. The surface area of a cube is 150 cm^2. Its volume is

1. 100 cm^3 2. 125 cm^3 3. 150 cm^3 4. 200 cm^3

Ans: 2

Explantion

$S = 6a^2$ and $V = a^3$

Given: $6a^2 = 150$

∴ a = 5 cm

∴ V = 125 cm^3

41. The slant height of a right circular cone is 10 m and its height 8 m. Find the area of its curved surface?

1. 60 π m^2 2. 50π m^2 3, 40π m^2 4. 30π m^2

Ans: 1

Explanation

For a right circular cone, $\ell = \sqrt{r^2 + h^2}$ and CSA = $\pi r\ell$

Given: ℓ = 10m, h = 8m ∴ r = 6m (Pythogorean triples)

CSA = $\pi r\ell = \pi \times 6 \times 10 = 60\pi$

42. If sin x = cos y, x + y is equal to

1. 30° 2. 45° 3. 60° 4. 90°

Ans:4.

Explanation

Only θ = 45° satisfies the given condition: sin x = cosx.

43. In the first quadrant, which one of the following is true?

1.cosθ increases when θ increases.
2.cosθ decreases when θ increases
3.cosθ remains constant
4.cosθ does not depend on θ

Ans: 2

Explanation
cos θ decreases from 1 to 0(i.e., from 0^o to 90^o)

44. In the first quadrant, which one of the following is true?
1.sin θ increases when θ increases
2.sin θ decreases when θ increases
3.sin θ remains constant
4.sin θ does not depend on θ

Ans: 1

Explanation:
sin θ increases from 0 to 1 (i.e., from 0^o to 90^o)

45. Which of the following is equal to 1?

1) $2^0 + 3^0 + 4^0$
2) $2^0 \times 3^0 \times 4^0$
3) $(3^0 - 2^0) \times 4^0$
4) $(3^0 - 2^0) \times (3^0 + 2^0)$

Ans: 2.

Explanation
Option 1. → 1 + 1 +1 = 3
2. →1 × 1 × 1 = 1
3. → 0 × 1 = 0
4. → 0 × 2 = 0

46. A right circular cylinder and a right circular cone have the same radius and height. The ratio of their volume is

1. 2:1
2. 3:1
3. 3:2
4. 4:3

Ans:2

Explanation:
Volume of cylinder = $\pi r^2 h$
Volume of cone = 1/3 $\pi r^2 h$
Volume of cylinder : Volume of cone =3:1
(Note: Remember that for the same radius and height for a cylinder and cone, cylinder volume is 3 times that of cone volume)

47. The height and radius of a cone are doubled. The volume of the cone becomes

1. 2 times 2, 4 times 3. 8 times 4. None

Ans: 3

Explantion

Volume of cone V = $\frac{1}{3}\pi r^2 h$

Given r → 2r, h → 2h

∴ Volume → $\frac{1}{3}\pi(2r)^2.(2h) = 8.\frac{1}{3}\pi r^2 h = 8V$

48. A hallow cone of height 24 cm and radius 7 cm is to be made. The total area of the sheet required is

1. 607 cm^2 2. 704 cm^2 3. 804 cm^2 4. None

Ans:2

Explanation

Given r = 7; h= 24; ∴ Slant side = $\ell = \sqrt{r^2 + h^2} \rightarrow \ell = 25$;

Total surface area, TSA = $\pi rl + \pi r^2$

=22/7 x 7 x 25 + 22/7 x 7 x 7

= 550 +154 = 704cm^2

49. Simplify:

a. 101 x 99

Ans. (100 + 1) (100 – 1) = 10000 – 1 = 9999

b. $128^2 - 22^2$

Ans. (128 + 22) (128 – 22) = 150 × 106 = 15900

50. Factorize each of the following:

(a)3x + 9

Ans. 3 (x+3)

(b) 5x – 10

Ans. 5(x-2)

(c) $2x^2 - x$

Ans: $x(2x-1)$

(d) $9x^2y - 3xy$

Ans: $3xy(3x-1)$

(h) $25x^2 - 49y^2$

Ans. $(5x + 7y)(5x - 7y)$