VQAR-II
Mensuration 2D Formula & Aptitude

1: Find the perimeter and area of an isosceles triangle whose equal sides are 5 cm and height is 4 cm.

Solution:

Applying Pythagoras' theorem,
(Hypotenuse)2 = (Base)2 + (Height)2
=> (5)2 = (0.5 x Base of isosceles triangle)2 + (4)2
=> 0.5 x Base of isosceles triangle = 3
=> Base of isosceles triangle = 6 cm
Therefore, perimeter = sum of all sides = 5 + 5 + 6 = 16 cm
Area of triangle = 0.5 x Base x Height = 0.5 x 6 x 4 = 12 cm2

2: A rectangular piece of dimension 22 cm x 7 cm is used to make a circle of the largest possible radius. Find the area of the circle formed.

Solution:

In questions like this, the diameter of the circle is lesser in length and breadth.
Here, the breadth Diameter of the circle = 7 cm
=> Radius of the circle = 3.5 cm
Therefore, area of the circle = π (Radius)2 = π (3.5)2 = 38.50 cm2

3: A pizza is to be divided into 8 identical pieces. What would be the angle subtended by each piece at the center of the circle?

Solution:

By identical pieces, we mean that area of each piece is the same.
=> Area of each piece = (π x Radius2 x θ) / 360 = (1/8) x Area of circular pizza
=> (π x Radius2 x θ) / 360 = (1/8) x (π x Radius2)
=> θ / 360 = 1 / 8
=> θ = 360 / 8 = 45
Therefore, the angle subtended by each piece at the center of the circle = 45 degrees

4: Four cows are tied to each corner of a square field of side 7 cm. The cows are tied with a rope such that each cow grazes the maximum possible field and all the cows graze in equal areas. Find the area of the ungrazed field.

Solution:

For maximum and equal grazing, the length of each rope has to be 3.5 cm.
=> Area grazed by 1 cow = (π x Radius2 x θ) / 360

=> Area grazed by 1 cow = (π x 3.52 x 90) / 360 = (π x 3.52) / 4
=> Area grazed by 4 cows = 4 x [(π x 3.52) / 4] = π x 3.52
=> Area grazed by 4 cows = 38.5 cm2
Now, area of square field = Side2 = 72 = 49 cm2
=> Area ungrazed = Area of field – Area grazed by 4 cows
=> Area ungrazed = 49 – 38.5 = 10.5 cm2

5: Find the area of the largest square that can be inscribed in a circle of radius 'r'.

Solution:

The largest square that can be inscribed in the circle will have the diameter of the circle as the diagonal of the square.
=> Diagonal of the square = 2 r
=> Side of the square = 2 r / 21/2
=> Side of the square = 21/2 r
Therefore, area of the square = Side2 = [21/2 r]2 = 2 r2

6: A contractor undertakes the job of fencing a rectangular field of length 100 m and breadth 50 m. The cost of fencing is Rs. 2 per meter and the labor charges are Re. 1 per meter, both paid directly to the contractor. Find the total cost of fencing if 10 % of the amount paid to the contractor is paid as tax to the land authority.

Solution :

Total cost of fencing per meter = Rs. 2 + 1 = Rs. 3
Length of fencing required = Perimeter of the rectangular field = 2 (Length + Breadth)
=> Length of fencing required = 2 x (100 + 50) = 300 meter
=> Amount paid to the contractor = Rs. 3 x 300 = 900
=> Amount paid to the land authority = 10 % of Rs. 900 = Rs. 90
therefore, total cost of fencing = Rs. 900 + 90 = Rs. 990

Mensuration 3D Aptitude

1: Find the length of the largest rod that can be kept in a cuboidal room of dimensions 10 x 15 x 6 m.

Solution:

Largest rod would lie along the diagonal.
=> Length of largest rod = Length of diagonal of the room = (L2 + B2 + H2)1/2
=> Length of the largest rod = (102 + 152 + 62)1/2 = (100 + 225 + 36)1/2 = (361)1/2
=> Length of the largest rod = 19 m

2: Find the number of bricks of dimension 24 x 12 x 8 cm each that would be required to make a wall 24 m long, 8 m high and 60 cm thick.

Solution:

Volume of 1 brick = 24 x 12 x 8 = 2304 cm 3
Volume of wall = 2400 x 800 x 60 = 115200000 cm 3
Therefore, number of bricks required = 115200000 / 2304 = 50000

3: A rectangular sheet of paper measuring 22 cm x 7 cm is rolled along the longer side to make a cylinder. Find the volume of the cylinder formed.

Solution:

Let the radius of the cylinder be 'R'.
The sheet is rolled along the longer side.
=> 2 π R = 22
=> R = 3.5 cm
Also, height = 7 cm
Therefore, volume of the cylinder = π R2 H = π (3.5)2 7 = 269.5 cm3

4: If each edge of a cube is increased by 10 %, what would be the percentage increase in volume?

Solution:

Let the original edge length be 'a'
=> Original volume = a3
Now, new edge length = 1.1 a
=> New volume = (1.1 a)3 = 1.331 a3
=> Increase in volume = 1.331 a3 – 1 a3 = 0.331 a3
Therefore, percentage increase int eh volume = (0.331 a3 / a3) x 100 = 33.1 %

5: Three metal cubes of edge lengths 3 cm, 4 cm, and 5 cm are melted to form a single cube. Find the edge length of such a cube.

Solution:

Volume of new cube = Volume of metal generated on melting the cubes = Sum of volumes of the three cubes
=> Volume of new cube = 3 3 + 4 3 + 5 3 = 216
=> Edge length of new cube = (216)1/3 = 6 cm

6: Find the length of a 1.25 m wide metal sheet required to make a conical machine of radius 7 m and height 24 m.

Solution:

The sheet would be shaped into a cone.
=> Area of sheet = Area of conical machine
=> 1.25 x Length = π x R x L
=> 1.25 x Length = π x R x (72 + 242)1/2
=> 1.25 x Length = π x 7 x 25

=> Length = 440 m
Thus, 440 m long metal sheet is required to make the conical machine.

7: From a cylindrical vessel having a radius of the base of 7 cm and a height 6cm, water is poured into small hemispherical bowls each of radius 3.5 cm. Find the minimum number of bowls that would be required to empty the cylindrical vessel.

Solution :

Volume of cylindrical vessel = π R2 H = π (72) 6 = 924 cm3
Volume of each bowl = (2 / 3) π R3 = (2 / 3) π 3.53 = 269.5 / 3
=> Number of bowls required = (924) / (269.5 / 3) = 10.28
But since a number of bowls cannot be in fractions, we need at least 11 such bowls to empty the cylindrical vessel.

MCQ Questions

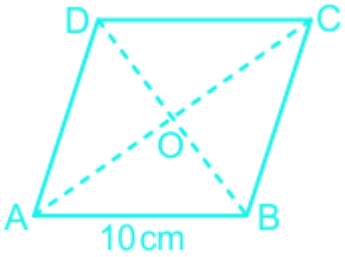
1. Total surface area of cylinder is 704 cm2 and ratio of height and base radius of the cylinder is 3 : 4, then what will be the volume of that cylinder?
1. 384π cm3
2. 243π cm3
3. 518π cm3
4. 423π cm3

Ans:

Let height and base radius of the cylinder is 3x and 4x respectively.
Total surface area of the cylinder = 2πr(h + r)
704 = 2 × (22/7) × 4x × (3x + 4x)
⇒ 704 = 176x/7 × (3x + 4x)
⇒ 704 = 176x2
⇒ x2 = 4
⇒ x = 2
Base radius = 4x = 8 cm
Height = 3x = 6 cm
Volume of the cylinder = πr2h = π × 64 × 6 = 384π cm3

2. If the length of the side of the rhombus is 10 cm and the length of the shorter diagonal is 12 cm then what is the area of the rhombus?
1. 96 cm2
2. 108 cm2
3. 80 cm2
4. 144 cm2

Ans:



By observing the given diagram and as we know that AOB is a right-angle triangle.
⇒ OB =12/2 = 6cm
⇒ AO = √(100 - 36) (Using Pythagoras theorem)
⇒ 8cm
⇒ AC = 16cm
⇒ Area of the diagonal = (1/2) × AC × BD
⇒ (1/2) × 16 × 12 = 96 cm2

3. What is the volume of a hexagonal prism of base length 5 cm and height 4√3 cm?
1. 360 cm3
2. 420 cm3
3. 450 cm3
4. 480 cm3

Ans:

Volume of prism = Area of base × Height
Area of hexagonal base = 3√3/2 × side2
⇒ 3√3/2 × 52 = 75√3/2
Volume of prism = 75√3/2 × 4√3
⇒ 450 cm3

4. The area of the circular park is 5544 m2. There is a 7m wide path for running inside the park. Park owners decide to pave the running track. If the cost of paving Rs 12 per meter square then find the total cost of paving the running track of the park.
1. Rs 12500
2. Rs 24520
3. Rs 18540
4. Rs 20328

Ans:

Area of circular park = πr2
⇒ 5544 = πr2
⇒ r2 = 5544/π = 1764 (where π = 22/7)
⇒ r = √1764 = 42 m
Path length is 7 m (given)
Inner circle area (without including path area)
Radius of inner circle = (42 - 7) m = 35 m
Area2 = 22/7 × 35 × 35 = 3850 m2
Total area of path = Area1 - Area2
= (5544 - 3850) m2
= 1694 m2
Total cost for paving = 1694 × 12
= Rs 20328

5. Amal has a toy that is in the shape of a regular tetrahedron and has a curved surface area of 800 cm2. Each face of the tetrahedron has a height of 20 cm. What is the length of the base of one of the faces?
1. 20 cm
2. 10 cm
3. 15 cm
4. 21 cm

Ans:

As we know that the regular tetrahedron has 4 triangular faces.
Area of one face = 800/4 = 200 cm2
Area of triangle = 1/2 × base × height.
200 = 1/2 × base × 20
Base = 20 cm.

6. Find the volume of a pyramid whose base is square in shape with an area of 225 sq.cm. and height is 11 cm.
1. 965 cu.cm
2. 741 cu.cm
3. 825 cu.cm
4. 786 cu.cm

Ans:

GivenArea of square base = 225 cm2
h = 11 cm
The volume of pyramid = 1/3 × Area of square base × h = 1/3 × 225 × 11 = 825 cm3

7. Ratio of curved surface area to total surface area of cylinder is 11 : 18. Also, area of its circular end is 616 cm2. Find the volume of cylinder.
1. 11576 cm3
2. 13552 cm3
3. 12785 cm3
4. 16415 cm3

Ans:
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The curved surface area of the cylinder = 2πrh
The total surface area of the cylinder = 2πr(r + h)
Ratio = 2πrh : 2πr(r + h) = h : (r + h)
Now, h : (r + h) = 11 : 18
⇒ 18h = 11r + 11h
⇒ 7h = 11r
⇒ h/r = 11/7
Also, πr2 = 616
⇒ r2 = 616/π
⇒ r2 = 196 = 14
⇒ h/r = 11/7 (if r is 14, then h must be 22)
Volume = π × r2 × h = (22/7) × 14 × 14 × 22 = 13552 cm3

8. The length and breadth of a rectangle are in a ratio 2 : 1 and the perimeter of the rectangle is 48 cm. Find the area of the rectangle.
1. 128 cm2
2. 256 cm2
3. 64 cm2
4. 144 cm2

Ans:

Area of rectangle = Length × Breadth
Perimeter of rectangle = 2(Length + Breadth)
Let, the length is 2x and the breadth is x (since the ratio is 2 : 1).
Now given,
⇒ 48 = 2(2x + x)
⇒ 48 = 6x
⇒ x = 8
So, Length = 16 cm and Breadth = 8 cm
Area = 16 × 8 = 128 cm2

9. The sides of the right-angle triangular park are in ratio 3 : 4. The sum of all sides is 144 m. Find the area of the triangular park.
1. 894 m2
2. 864 m2
3. 926 m2
4. 1024 m2

Ans:

The park is of right angle triangle shape so, the triplet of sides is (3,4,5).
Let the side of the park be 3x, 4x, 5x
Sum of sides = 12x = 144
⇒ x = 12
Thus, sides are 36 m, 48 m, 60m
The area of triangle = (1/2) × 36 × 48 = 864 m2

10. What is the volume of the sphere whose radius is 14cm?
1. 22158.33
2. 11699.67
3. 11250.33
4. None of these

Ans:

The volume of the sphere = (4/3)πr3
Where r is the radius of the sphere.
⇒ (4/3) × (22/7) × 14 × 14 × 14
⇒ 11,498.66 cm3