

NTS GAT General Past Papers Questions

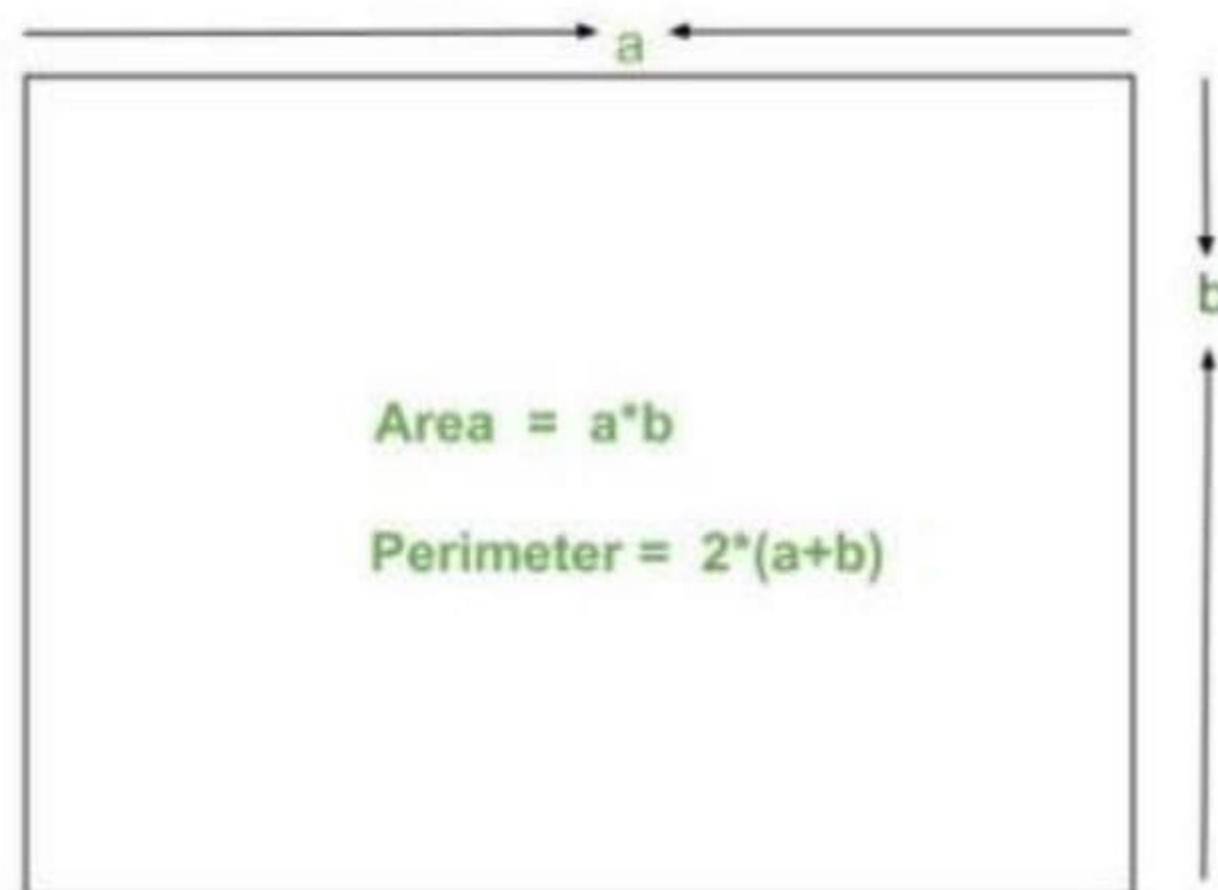
Quantitative – Exam No. 07

Geometrical Figures Problems

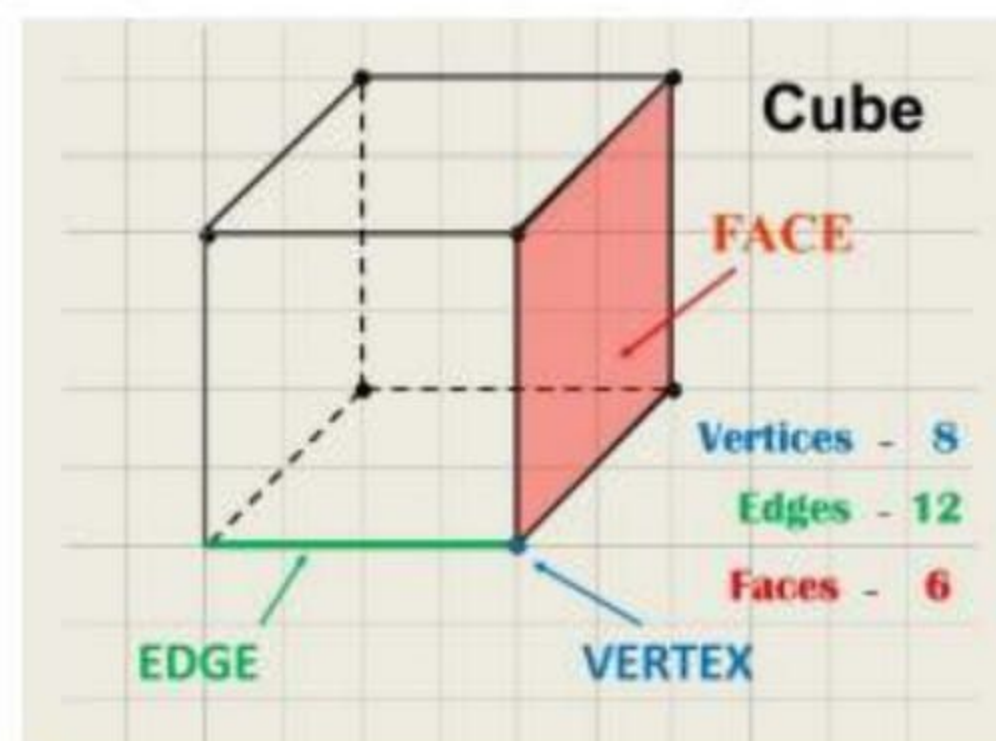
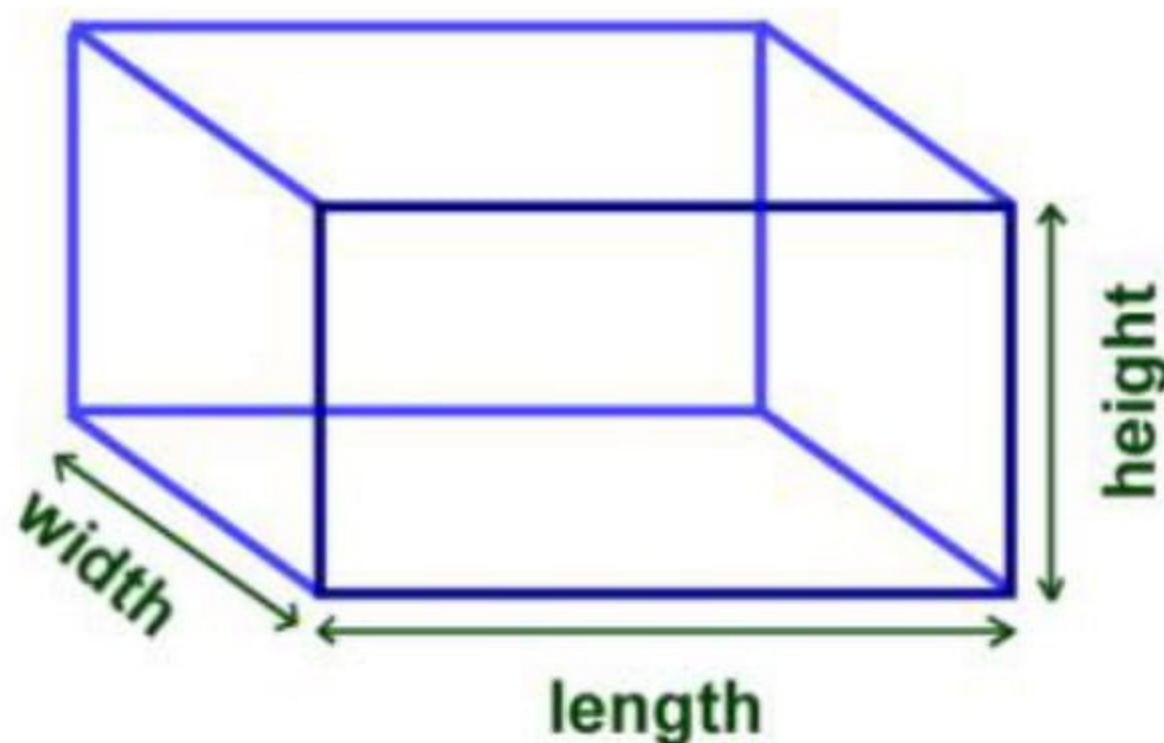
Prepared by: GAT Online Tutor

Formulas (Basic):

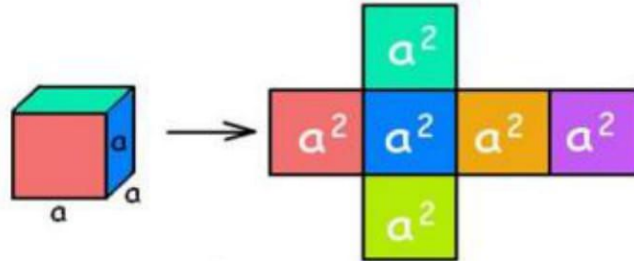
1. *Area of rectangle* = $A = \text{Length} \times \text{Width}$
2. *Perimeter of rectangle* = $P = 2(\text{Length} + \text{Width})$



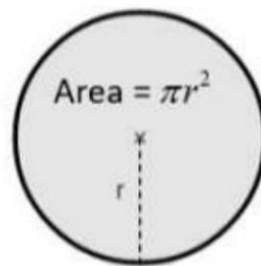
3. *Area of square* = $A = (\text{Length of one side})^2$
4. *Volume of cube* = $V = (\text{Length of one side})^3$
5. *Volume of cuboid* = $V = \text{Length} \times \text{Width} \times \text{Height}$



6. Surface area of cube = $S = 6L^2$

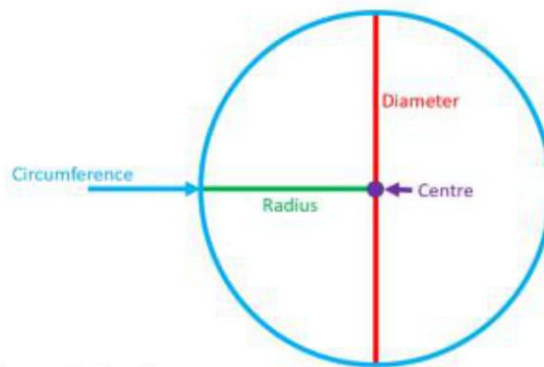


7. Area of circle = $A = \pi r^2$



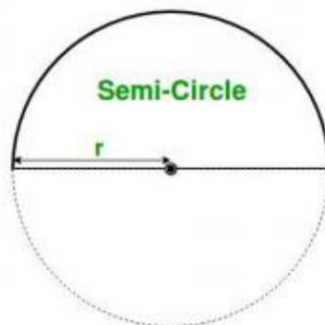
8. Circumference of circle = $C = 2\pi r$

9. Diameter of a circle = $d = 2r$

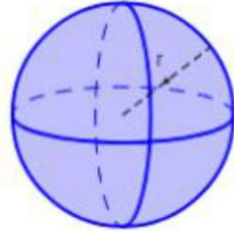


10. Perimeter of semi circle = $\pi r + 2r$

11. Perimeter of semi circle = $\frac{\pi d}{2} + d$



12. Volume of sphere = $\frac{4}{3}\pi r^3$ (PP)



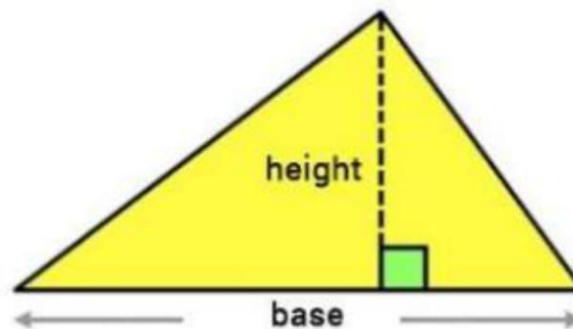
Volume of Sphere

$$= \frac{4}{3}\pi r^3$$

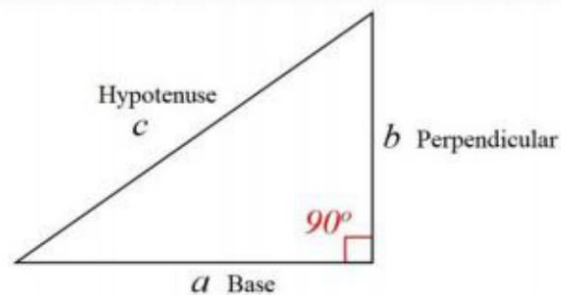
13. Surface area of sphere = $S = 4\pi r^2$



14. Area of triangle = $\frac{1}{2} \times \text{Base} \times \text{Height}$

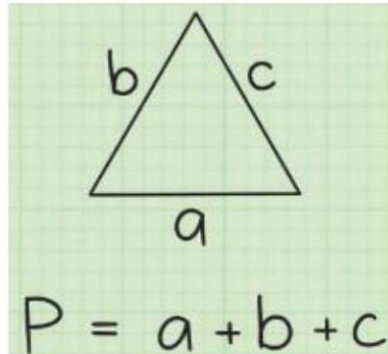


15. $(\text{Hypotenuse})^2 = (\text{Base})^2 + (\text{Perpendicular})^2$

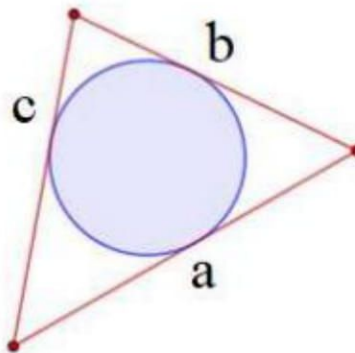


$$c^2 = a^2 + b^2$$

16. Perimeter of triangle = Sum of three sides = $a + b + c$



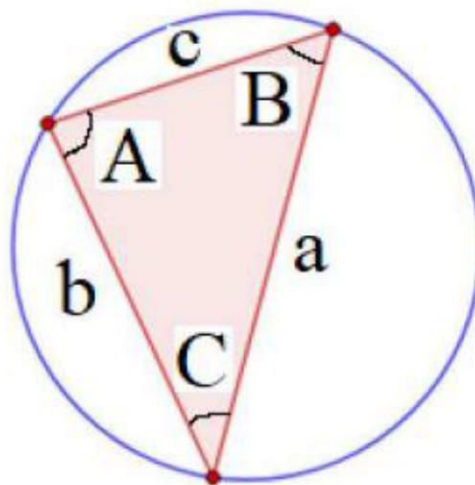
17. Area of inscribed circle = $\frac{1}{2} \times r \times P = \frac{1}{2} \times r \times (a + b + c)$



18. Area of circum circle = $\frac{abc}{4R}$,

Where:

$$R = \frac{a}{2 \sin A} = \frac{b}{2 \sin B} = \frac{c}{2 \sin C}$$



19.If radius of circle is increased by $x\%$, then percentage increase in the area of the circle is given as follows:

$$\text{Percentage increase in area} = x + x + \frac{x^2}{100}$$

20.If radius of circle is decreased by $x\%$, then percentage decrease in the area of the circle is given as follows:

$$\text{Percentage decrease in area} = x + x - \frac{x^2}{100}$$

21.Total surface area of cylinder (including ends):

- In the form of diameter:

$$\text{Total surface area} = \pi d_i h + \pi d_o h + \frac{\pi(d_o^2 - d_i^2)}{2}$$

- In the form of radius:

$$\text{Total surface area} = 2\pi r_i h + 2\pi r_o h + 2\pi(r_o^2 - r_i^2)$$

22.Total surface area of cylinder (excluding ends):

- In the form of diameter:

$$\text{Total surface area} = \pi d_i h + \pi d_o h$$

- In the form of radius:

$$\text{Total surface area} = 2\pi r_i h + 2\pi r_o h$$

Formulas (Derived):

1. Area of circle = $A = \frac{\pi}{4}d^2$

2. Circumference of circle = $C = \pi d$

3. Area of circle = $A = \frac{C^2}{4\pi}$

4. Circumference of circle = $C = 2\sqrt{\pi A}$

5. $(\text{Base})^2 = (\text{Hypotenuse})^2 - (\text{Perpendicular})^2$

6. $(\text{Perpendicular})^2 = (\text{Hypotenuse})^2 - (\text{Base})^2$

Exercise:

1. The length of a garden is 7 km and its area is 35 km². Find its width?

Solution:

$$\text{Area} = \text{Length} \times \text{Width}$$

$$35 = 7 \times \text{Width}$$

$$\text{Width} = \frac{35}{7} = 5 \text{ km}$$

2. The volume of a cube is 64 cm³. Find the length of each side? (PP)

Solution:

$$\text{Volume of cube} = V = (\text{Length of one side})^3$$

$$64 = (\text{Length of one side})^3$$

$$(4)^3 = (\text{Length of one side})^3$$

$$\text{Length of one side} = 4 \text{ cm}$$

3. Sum of all edges of cube is 24 cm. Find the volume of cube? (PP)

Solution:

A cube has all sides equal in length and possess 12 edges.

$$\text{Length of one side} = \frac{24}{12} = 2 \text{ cm}$$

$$\text{Volume of cube} = V = (\text{Length of one side})^3$$

$$\text{Volume of cube} = V = (2)^3$$

$$\text{Volume of cube} = V = 8 \text{ (cm)}^3$$

4. The area of the circle is 154 units. Find the radius of the circle? (PP)

Solution:

$$A = \pi r^2$$

$$154 = \frac{22}{7} \times r^2$$

$$r^2 = \frac{154 \times 7}{22}$$

$$r^2 = 49$$

$$r = 7 \text{ units}$$

5. The circumference of a circle is 64π . Find its area? (PP)

Solution:

$$A = \frac{C^2}{4\pi}$$

$$A = \frac{(64\pi)^2}{4\pi}$$

$$A = \frac{4096\pi^2}{4\pi}$$

$$A = 1024\pi$$

6. If the radius of the circle is increased by two times, find the change in area of the circle? (PP)

Solution:

$$A = \pi r^2$$

$$r(\text{new}) = 2r$$

$$A(\text{new}) = \pi(2r)^2$$

$$A(\text{new}) = \pi(4r^2)$$

$$A(\text{new}) = 4(\pi r^2)$$

$$A(\text{new}) = 4A$$

Area of circle will increase four times.

7. Find the area of a circle whose diameter is 2? (PP)

Solution:

$$A = \frac{\pi}{4}d^2$$

$$A = \frac{\pi}{4}(2)^2$$

$$A = \frac{\pi}{4}(4)$$

$$A = \pi$$

8. A circle with a radius of 3 feet has a circumference equal to what? (PP)

Solution:

$$C = 2\pi r$$

$$C = 2 \times \pi \times 3$$

$$C = 6\pi$$

9. The length of a rectangle is thrice its width. If length is 18 m. Find the area?

Solution:

$$L = 3W$$

$$18 = 3W$$

$$W = \frac{18}{3} = 6$$

$$A = L \times W$$

$$A = 18 \times 6 = 108 \text{ m}^2$$

10. The ratio of length to width of a box is 7:3. If the area is 84 square units.

Find the width of the box? (PP)

Solution:

$$L : W = 7 : 3$$

$$\frac{L}{W} = \frac{7}{3}$$

$$L = \frac{7W}{3}$$

Given the area of rectangle is 84 square units:

$$A = L \times W$$

$$84 = \frac{7W}{3} \times W$$

$$84 \times 3 = 7W^2$$

$$W^2 = \frac{84 \times 3}{7}$$

$$W^2 = 36$$

$$\sqrt{W^2} = \sqrt{36}$$

$$W = 6 \text{ units}$$

11. The length of a room is 7 m and width is 5 m. Find the cost of floor slab at a rate of Rs. 100 per square meter? (PP)

Solution:

$$A = L \times W$$

$$A = 7 \times 5$$

$$A = 35 \text{ m}^2$$

$$\text{Cost} = A \times \text{unit price}$$

$$\text{Cost} = 35 \times 100$$

$$\text{Cost} = 3,500 \text{ rupees}$$

12. Find the percentage change in the area of a rectangle when its length is increased by 50% and width remains the same? (PP)

Solution:

$$A = L \times W$$

$$L(\text{new}) = L + \frac{50}{100}L = L + 0.5L = 1.5L$$

$$W(\text{new}) = W$$

$$A(\text{new}) = L(\text{new}) \times W(\text{new})$$

$$A(\text{new}) = 1.5L \times W$$

$$A(\text{new}) = 1.5 \times L \times W$$

$$A(\text{new}) = 1.5A$$

The area of new rectangle will increase by 50%.

13. A square tile is 3 inches long. How many tiles are required to cover a rectangular floor of 30 ft x 40 ft? (PP)

Solution:

$$\text{Area of one tile} = 3 \text{ inches} \times 3 \text{ inches}$$

$$\text{Area of one tile} = 9 \text{ inches}^2$$

$$\text{Floor area} = 30 \text{ ft} \times 40 \text{ ft}$$

$$\text{Floor area} = (30 \times 12) \text{ inches} \times (40 \times 12) \text{ inches}$$

$$\text{Floor area} = 360 \text{ inches} \times 480 \text{ inches}$$

$$\text{Tiles required} = \frac{\text{Floor area}}{\text{Area of one tile}}$$

$$\text{Tiles required} = \frac{360 \times 480}{9}$$

$$\text{Tiles required} = 40 \times 480$$

$$\text{Tiles required} = 19,200$$

14. What will be perimeter of semi-circle having 56 cm diameter? (PP)

Solution:

We know that:

$$\text{Perimeter of semi circle} = \frac{\pi d}{2} + d$$

Putting the value of diameter, we get:

$$\text{Perimeter of semi circle} = \frac{\frac{22}{7} \times 56}{2} + 56$$

$$\text{Perimeter of semi circle} = \frac{22 \times 8}{2} + 56$$

$$\text{Perimeter of semi circle} = 11 \times 8 + 56$$

$$\text{Perimeter of semi circle} = 88 + 56$$

$$\text{Perimeter of semi circle} = 144 \text{ cm}$$

15. What will be perimeter of semi-circle having 7 feet radius?

Solution:

We know that:

$$\text{Perimeter of semi circle} = \pi r + 2r$$

Putting the value of radius, we get:

$$\text{Perimeter of semi circle} = \frac{22}{7} \times 7 + 2(7)$$

$$\text{Perimeter of semi circle} = 22 + 14$$

$$\text{Perimeter of semi circle} = 36 \text{ feet}$$

16. A 5 feet long cylindrical pipe has an inner diameter of 6 feet and an outer diameter of 8 feet. If the total surface area (excluding the ends) is $k\pi$, what is the value of k ? (PP)

Solution:

We know that:

$$\text{Total surface area} = \text{Inside} + \text{Outside}$$

$$k\pi = \pi d_i h + \pi d_o h$$

$$k\pi = \pi(6 \times 5) + \pi(8 \times 5)$$

$$k\pi = 30\pi + 40\pi$$

$$k\pi = 70\pi$$

$$k = 70$$

17. If the radius of the circle is increased 6%, then find the percentage increase in the area of the circle? (PP)

Solution:

$$\text{Percentage increase in radius} = x = 6\%$$

We know that:

$$\text{Percentage increase in area} = x + x + \frac{x^2}{100}$$

Substituting the value of x, we get:

$$\text{Percentage increase in area} = 6 + 6 + \frac{(6)^2}{100}$$

$$\text{Percentage increase in area} = 6 + 6 + \frac{36}{100}$$

$$\text{Percentage increase in area} = 6 + 6 + 0.36$$

$$\text{Percentage increase in area} = 12.36 \%$$

18. A solid metal cube of edge 3 feet is placed in a rectangular tank whose length, width and height are 3, 4 and 5 feet respectively. What is the volume, in cubic feet, of water that the tank can now hold? (PP)

Solution:

$$\text{Volume of cube} = (\text{Length of one side})^3$$

$$\text{Volume of cube} = (3)^3$$

$$\text{Volume of cube} = 27 \text{ ft}^3$$

$$\text{Volume of tank} = \text{Length} \times \text{Width} \times \text{Height}$$

$$\text{Volume of tank} = 3 \times 4 \times 5$$

$$\text{Volume of tank} = 60 \text{ ft}^3$$

$$\text{Remaining capacity of tank} = \text{Volume of tank} - \text{Volume of cube}$$

$$\text{Remaining capacity of tank} = 60 - 27$$

$$\text{Remaining capacity of tank} = 33 \text{ ft}^3$$

19. Sum of all edges of cube is 6 cm. Find the volume of cube? (PP)

Solution:

A cube has all sides equal in length and possess 12 edges.

$$\text{Length of one side} = \frac{6}{12} = \frac{1}{2} \text{ cm}$$

$$\text{Volume of cube} = V = (\text{Length of one side})^3$$

$$\text{Volume of cube} = V = \left(\frac{1}{2}\right)^3$$

$$\text{Volume of cube} = V = \frac{1}{8} (\text{cm})^3$$

20. What is the length of the largest distance between two corners in a rectangular box with the dimensions 3 inches by 4 inches by 5 inches? (PP)

Solution:

See $\triangle ABD$, we have:

$$(BD)^2 = (AB)^2 + (AD)^2$$

$$(BD)^2 = (3)^2 + (4)^2$$

$$(BD)^2 = 9 + 16 = 25$$

$$BD = 5 \text{ inches}$$

See $\triangle BDH$, we have:

$$(BH)^2 = (BD)^2 + (HD)^2$$

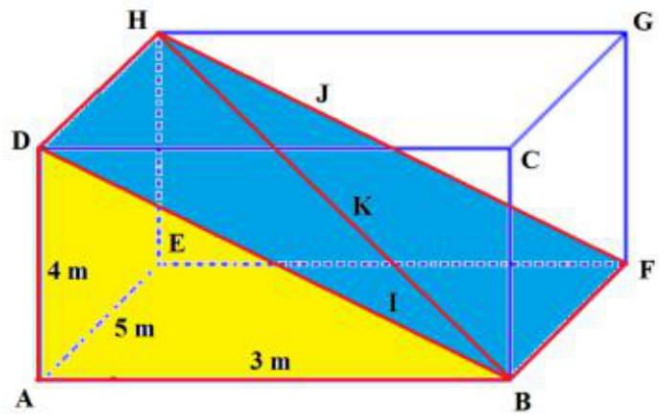
$$(BH)^2 = (5)^2 + (5)^2$$

$$(BH)^2 = 25 + 25 = 50$$

$$BH = \sqrt{50} = \sqrt{2 \times 5 \times 5}$$

$$BH = \sqrt{2 \times 5^2} = \sqrt{2} \times \sqrt{5^2}$$

$$BH = 5\sqrt{2} \text{ inches}$$



21. Length of a rectangle is increased by 20% and width is decreased by 20%, find the percentage change in the area of a rectangle? (PP)

Solution:

$$A = L \times W$$

$$L(\text{new}) = L + \frac{20}{100}L = L + 0.2L = 1.2L$$

$$W(\text{new}) = W - \frac{20}{100}W = W - 0.2W = 0.8W$$

$$A(\text{new}) = L(\text{new}) \times W(\text{new})$$

$$A(\text{new}) = 1.2L \times 0.8W$$

$$A(\text{new}) = 0.96 \times L \times W$$

$$A(\text{new}) = 0.96A$$

The area of new rectangle will decrease by 4%.

22. If the ratio of the areas of 2 squares is 2 : 1, then find the ratio of perimeter of the squares? (PP)

Solution:

$$A_1 : A_2 = 2 : 1$$

$$A_1 = (\text{Length of one side})^2$$

$$2 = (L_1)^2$$

$$\sqrt{2} = \sqrt{(L_1)^2}$$

$$L_1 = \sqrt{2}$$

$$\text{Perimeter of first square} = P_1$$

$$= 4L_1$$

$$P_1 = 4(\sqrt{2}) = 4\sqrt{2}$$

$$A_2 = (\text{Length of one side})^2$$

$$1 = (L_2)^2$$

$$1 = \sqrt{(L_2)^2}$$

$$L_2 = 1$$

$$\text{Perimeter of second square} = P_2$$

$$= 4L_2$$

$$P_2 = 4(1) = 4$$

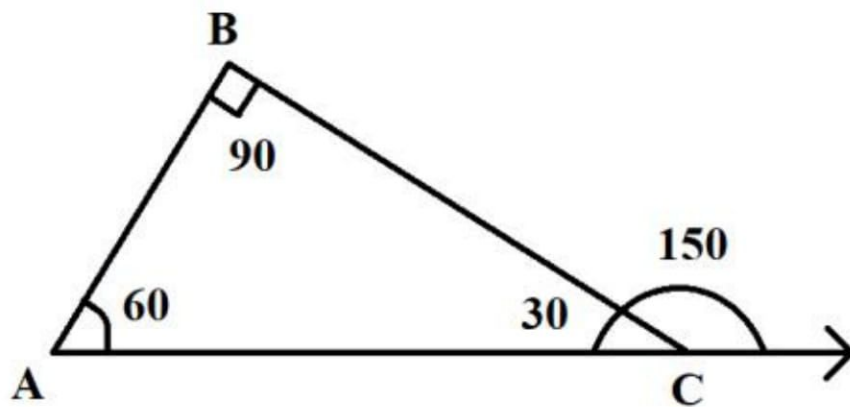
$$\text{Ratio} = \frac{P_1}{P_2}$$

$$\text{Ratio} = \frac{4\sqrt{2}}{4}$$

$$\text{Ratio} = \frac{\sqrt{2}}{1}$$

$$\text{Ratio} = \sqrt{2} : 1$$

23. In the given figure, the length AB is 4 units. Find the length AC? (PP)



Solution:

We know that:

$$\cos \theta = \frac{\text{Base}}{\text{Hypotenuse}}$$

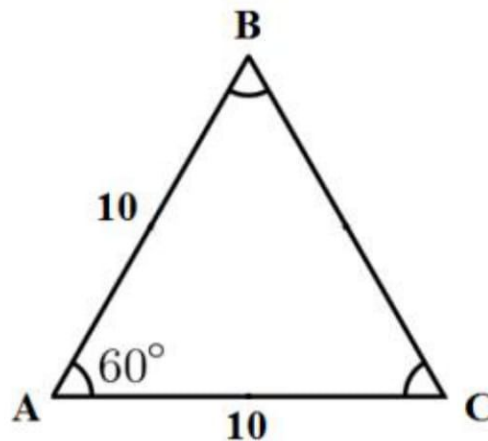
$$\cos \theta = \frac{AB}{AC}$$

$$AC = \frac{AB}{\cos \theta} = \frac{4}{\cos 60}$$

$$AC = \frac{4}{1/2} = 4 \times 2$$

$$AC = 8 \text{ units}$$

24. In the below figure, what is the perimeter of $\triangle ABC$? (PP)

**Solution:**

We know the sum of all angles of a triangle is 180 degrees. This is an equilateral triangle so all three sides will be equal in length, so the perimeter of the triangle will be as follows:

$$\text{Perimeter of } \triangle ABC = 10 + 10 + 10$$

$$\text{Perimeter of } \triangle ABC = 30$$

25. How many bricks 20 cm by 10 cm will be required to pave the floor of a room 8 m long and 5 m wide? (PP)

Solution:

$$\text{Area of one brick} = 20 \text{ cm} \times 10 \text{ cm}$$

$$\text{Area of one brick} = 200 \text{ cm}^2$$

$$\text{Floor area} = 8 \text{ m} \times 5 \text{ m}$$

$$\text{Floor area} = (8 \times 100) \text{ cm} \times (5 \times 100) \text{ cm}$$

$$\text{Floor area} = (800) \text{ cm} \times (500) \text{ cm}$$

$$\text{Bricks required} = \frac{\text{Floor area}}{\text{Area of one brick}}$$

$$\text{Bricks required} = \frac{800 \times 500}{200}$$

$$\text{Bricks required} = 4 \times 500$$

$$\text{Bricks required} = 2,000$$

26.If the area of rectangle is equal to area of square, then what should be the perimeter of rectangle? (PP)

Solution:

We know that:

$$\text{Area of recatngle} = L \times W$$

$$\text{Area of square} = L \times L$$

Also, given that they are equal, so:

$$\text{Area of recatngle} = \text{Area of square}$$

$$L \times W = L \times L$$

$$W = L$$

We know that perimeter of rectangle is:

$$\text{Perimeter of rectangle} = 2(L + W) = 2(L + L)$$

$$\text{Perimeter of rectangle} = 2(2L) = 4L$$

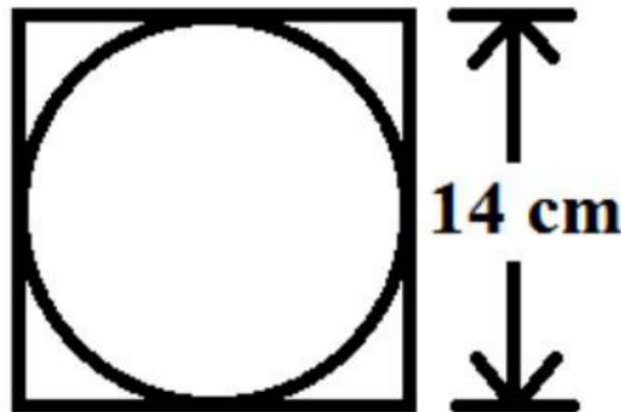
We know that perimeter of square is:

$$\text{Perimeter of square} = 4L$$

Hence, the perimeter of rectangle must be equal to the perimeter of square.

27. Find the area of the largest circle that can be drawn inside a square of side 14 cm in length? (PP)

Solution:



In the figure above, 14 cm is the diameter of the circle. We know that:

$$\text{Area of circle} = \frac{\pi}{4} d^2$$

$$\text{Area of circle} = \frac{22/7}{4} \times 14 \times 14$$

$$\text{Area of circle} = \frac{22}{4 \times 7} \times 14 \times 14$$

$$\text{Area of circle} = \frac{11}{2 \times 1} \times 2 \times 14$$

$$\text{Area of circle} = 11 \times 14$$

$$\text{Area of circle} = 154 \text{ (cm)}^2$$

28. Let $A = \text{Total area of five circles of radius 'r'}$, and let $B = \text{Total area of three circles of radius 's'}$. If $A = B$, then find r/s ? (PP)

Solution:

Given that:

$$A = \text{Total area of five circles of radius 'r'}$$

$$A = \pi r^2 + \pi r^2 + \pi r^2 + \pi r^2 + \pi r^2 = 5\pi r^2$$

$B = \text{Total area of three circles of radius 's'}$

$$B = \pi s^2 + \pi s^2 + \pi s^2 = 3\pi s^2$$

Given that area A is equal to area B, so:

$$A = B$$

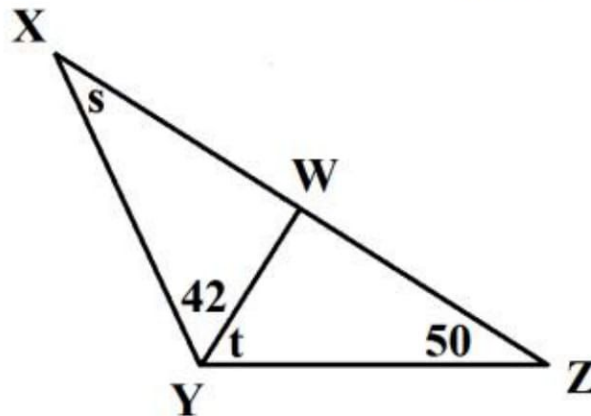
$$5\pi r^2 = 3\pi s^2$$

$$5r^2 = 3s^2$$

$$\frac{r^2}{s^2} = \frac{3}{5}$$

$$\frac{r}{s} = \sqrt{\frac{3}{5}} = \frac{\sqrt{3}}{\sqrt{5}}$$

29. In the figure below, what is 's' in terms of 't'? (PP)



Solution:

We know that sum of all angles of a triangle is 180 degrees. So, consider $\triangle XYZ$:

$$\angle X + \angle Y + \angle Z = 180$$

$$s + (42 + t) + 50 = 180$$

$$s = 180 - 42 - t - 50$$

$$s = 88 - t$$

30. Find cost of boundary wall paint of a garden at a rate of Rs. 20 per feet if the length and width of the garden are 300 ft and 200 ft respectively? (PP)

Solution:

$$\text{Perimeter} = P = 2(L + W)$$

$$P = 2(300 + 200)$$

$$P = 2(500)$$

$$P = 1,000 \text{ ft}$$

$$\text{Cost} = P \times \text{unit price}$$

$$\text{Cost} = 1,000 \times 20$$

$$\text{Cost} = 20,000 \text{ rupees}$$

31. If perimeter of a rectangle is 68 yards and width is 48 feet. Find length? (PP)

Solution:

We know that 1-yard equals 3 feet.

$$P = 2(L + W)$$

$$68 \times 3 = 2(L + 48)$$

$$204 = 2(L + 48)$$

$$\frac{204}{2} = (L + 48)$$

$$(L + 48) = 102$$

$$L = 102 - 48$$

$$L = 54 \text{ ft}$$

$$L = 18 \text{ yards}$$

32. Length of rectangle is doubled and width is halved. Find change in area?
(PP)

Solution:

$$A = L \times W$$

$$L(\text{new}) = 2L$$

$$W(\text{new}) = \frac{W}{2}$$

$$A(\text{new}) = L(\text{new}) \times W(\text{new})$$

$$A(\text{new}) = 2L \times \frac{W}{2}$$

$$A(\text{new}) = L \times W$$

$$A(\text{new}) = A \text{ (No change)}$$

33. Find the percentage change in the area of a rectangle when its length is increased by 30% and width is decreased by 20%? (PP)

Solution:

$$A = L \times W$$

$$L(\text{new}) = L + \frac{30}{100}L = L + 0.3L = 1.3L$$

$$W(\text{new}) = W - \frac{20}{100}W = W - 0.2W = 0.8W$$

$$A(\text{new}) = L(\text{new}) \times W(\text{new})$$

$$A(\text{new}) = 1.3L \times 0.8W$$

$$A(\text{new}) = 1.04 \times L \times W$$

$$A(\text{new}) = 1.04A$$

The area of new rectangle will increase by 4%.

34. If width and length of the rectangle are 5 m and 12 m respectively, and there is a circum-scribed circle, then find the diameter of the circle? (PP)

Solution:

