

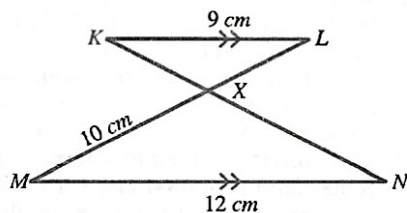
2024 WASSCE MATHEMATICS

OBJECTIVE TEST QUESTIONS

- Multiply 3.4×10^{-5} by 7.1×10^8 and leave the answer in standard form. A. 2.414×10^2 B. 2.414×10^3 C. 2.414×10^4 D. 2.414×10^5
- Given that $P = \{p : 1 < p < 20\}$, where p is an integer and $R = \{r : 0 \leq r \leq 25, \text{ where } r \text{ is a multiple of } 4\}$. Find $P \cap R$. A. $\{4, 8, 10, 10, 16\}$ B. $\{4, 8, 12, 16\}$ C. $\{4, 8, 12, 16, 20\}$ D. $\{4, 8, 12, 16, 20, 24\}$
- The First term of an Arithmetic Progression (A.P) is 2 and last term is 29. If the common difference is 3, how many terms are in the A.P? A. 8 B. 9 C. 10 D. 11
- Express in index form: $\log_a^x + \log_a^y = 3$. A. $x + y = 3$ B. $xy = 3$ C. $x + y = a^3$ D. $xy = a^3$
- Simplify: $(2p - q)^2 - (p + q)^2$. A. $3p(p - 2q)$ B. $2p(p - 3q)$ C. $3p(2p - q)$ D. $2p(3p - q)$
- If $(3 - 4\sqrt{2})(1 + 3\sqrt{2}) = a + b\sqrt{2}$, find the value of b . A. 5 B. -5 C. -21 D. 21
- Find the time for which \$1,250.00 will amount to \$2,031.25 at 12.5% per annum simple interest. A. 2 years B. 3 years C. 4 years D. 5 years
- If $\log_3^{(2x-1)} = 5$, find the value of x . A. 8 B. 16 C. 64 D. 122
- The population of a town increases by 3% every year. In the year 2000, the population was 3,000. Find the population in the year 2003. A. 3,182 B. 3,278 C. 6,591 D. 7,515
- A trader gave a change of #540.00 instead of #570.00 to a customer. Calculate the percentage error. A. $5\frac{5}{19}\%$ B. $5\frac{5}{9}\%$ C. $5\frac{7}{19}\%$ D. $5\frac{7}{9}\%$
- An interior angle of a regular polygon is 168° . Find the number of sides of the polygon. A. 30 B. 24 C. 15 D. 12
- If $3x - 2y = -5$ and $x + 2y = 9$, find the value of $\frac{x-y}{x+y}$. A. $5/3$ B. $3/5$ C. $-3/5$ D. $-5/3$
- A variable W varies partly as M and partly inversely as P . Which of the following correctly represents the relation with k_1 and k_2 constants? A. $W = \frac{k_1 M}{k_2 P}$ B. $W = (k_1 + k_2) \frac{M}{P}$

C. $W = k_1 M + \frac{k_2}{P}$
D. $W = (k_1 + k_2) M + P$

- A cylindrical metallic barrel of height 2.5 m and radius 0.245 is closed at one end. Find, correct to one decimal place, the total surface area of the barrel. [Take $\pi = 22/7$]. A. 2.1 m^2 B. 3.5 m^2 C. 4.0 m^2 D. 9.4 m^2
- Make R the subject of the relation $V = \pi l(R^2 - r^2)$. A. $R = \sqrt{\frac{V}{\pi l} + r^2}$ B. $R = \sqrt{\frac{V}{\pi l} - r^2}$ C. $R = \sqrt{V - \pi l r^2}$ D. $R = \sqrt{V + \pi l r^2}$
- Consider the following statements:
 m : Edna is respectful
 n : Edna is brilliant.
If $m \Rightarrow n$, which of the following is valid? A. $\sim m \Rightarrow \sim n$ B. $n \Rightarrow \sim m$ C. $\sim n \Rightarrow \sim m$ D. $n \Rightarrow m$
- A number is added to both the numerator and the denominator of the fraction $\frac{1}{8}$. If the result is $\frac{1}{2}$, find the number. A. 3 B. 4 C. 5 D. 6
- Gift, Justina and Frank shared 60 oranges in the ratio 5 : 3 : 7 respectively. How many oranges did Justina receive? A. 12 B. 16 C. 20 D. 28
- Find the quadratic equation whose roots are $\frac{2}{3}$ and -1 . A. $3x^2 + x - 2 = 0$ B. $3x^2 - x - 2 = 0$ C. $3x^2 + x + 2 = 0$ D. $3x^2 + x - 1 = 0$
- A piece of rod of length 44 m is cut to form a rectangular shape such that the ratio of the length to the breadth is 7 : 4. Find the breadth. A. 8 m B. 14 m C. 16 m D. 24 m

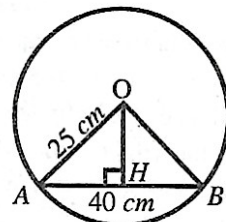


NOT DRAWN TO SCALE

In the diagram, $\overline{MN} \parallel \overline{KL}$, \overline{ML} and \overline{KN} intersect at X . $|\overline{MN}| = 12 \text{ cm}$, $|\overline{MX}| = 10 \text{ cm}$ and $|\overline{KL}| = 9 \text{ cm}$. If the area of $\triangle MXN$ is 16 cm^2 , calculate the area of $\triangle LKX$.

- A. 8 cm^2 B. 9 cm^2 C. 10 cm^2 D. 12 cm^2
- A ladder 15 m long leans against vertical pole, making an angle of 72° with the horizontal. Calculate, correct to one decimal place, the distance between the foot of the ladder and the pole. A. 15.8 m B. 14.3 m C. 4.9 m D. 4.6 m

23.

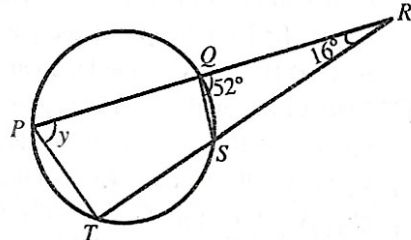


NOT DRAWN TO SCALE

In the diagram, O is the centre of the circle. If $|\overline{OA}| = 25 \text{ cm}$ and $|\overline{AB}| = 40 \text{ cm}$, find $|\overline{OH}|$.

- A. 15 cm B. 20 cm C. 25 cm D. 30 cm
- Given that P is 25 m on a bearing of 330° from Q , how far south of P is Q ? A. 25.2 m B. 21.7 m C. 19.8 m D. 18.5 m
 - A car valued at \$600,000.00 depreciates by 10% each year. What will be the value of the car at the end of two years? A. \$120,000.00 B. \$480,000.00 C. \$486,000.00 D. \$540,000.00
 - The length and breadth of a cuboid are 15 cm and 8 cm respectively. If the volume of the cuboid is $1,560 \text{ cm}^3$, calculate the total surface area. A. 976 cm^2 B. 383 cm^2 C. 792 cm^2 D. 746 cm^2
 - The number 1621 was subtracted from 6244 in base x . If the result was 4323, find x . A. Seven B. Eight C. Nine D. Ten
 - Factorize completely: $27x^2 - 48y^2$. A. $3(3x + 4y)(3x + 4y)$ B. $3(3x + 4y)(3x - 4y)$ C. $3(9x - 16y)(9x + 16y)$ D. $3(9x - 16y)(9x - 16y)$
 - For what values of x is $\frac{x-3}{4} + \frac{x+1}{8} \geq 2$? A. $x \geq 5$ B. $x \geq 6$ C. $x \geq 7$ D. $x \geq 8$

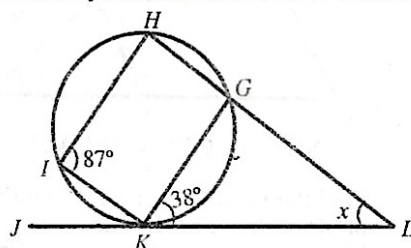
30.



NOT DRAWN TO SCALE

In the diagram, $\angle SQR = 52^\circ$ and $\angle PRT = 16^\circ$. Find the value of the angle marked y . A. 64° B. 68° C. 112° D. 128°

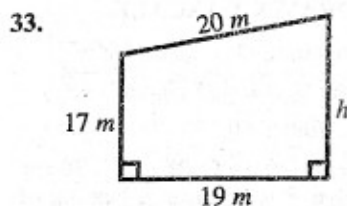
31.



NOT DRAWN TO SCALE

In the diagram, JKL is a tangent to the circle $GHIK$ at K . $\angle LKG = 38^\circ$ and $\angle LKG = 87^\circ$. Calculate the value of the angle marked x . A. 93° B. 55° C. 42° D. 23°

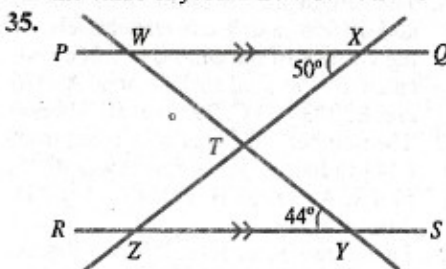
32. A cone and a cylinder are of equal volume. The base radius of the cone is twice the radius of the cylinder. What is the ratio of the height of the cylinder to that of the cone? A. $5 : 4$ B. $4 : 3$ C. $3 : 2$ D. $3 : 4$



NOT DRAWN TO SCALE

Find, correct to the nearest whole number, the value of h in the diagram.

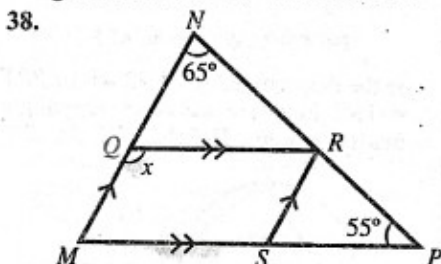
- A. 15 m B. 22 m C. 23 m D. 18 m
34. The gradient of the line joining the points $P(2, -8)$ and $Q(1, y)$ is -4 . Find the value of y . A. 2 B. 4 C. -4 D. -3



NOT DRAWN TO SCALE

In the diagram, $\overline{PQ} \parallel \overline{RS}$, $\angle WYZ = 44^\circ$ and $\angle WXY = 50^\circ$. Find $\angle WTX$.

- A. 65° B. 68° C. 86° D. 90°
36. The perimeter of a rectangular garden is 90 m . If the width is 7 m less than the length, find the length of the garden. A. 19 m B. 23 m C. 24 m D. 26 m
37. Four of the angles of a hexagon sum up to 420° . If the remaining angles are equal, find the value of each of the angles. A. 60° B. 100° C. 120° D. 150°

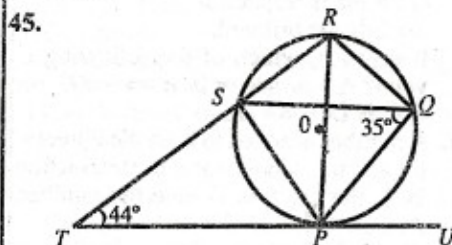


NOT DRAWN TO SCALE

Find the value of x in the diagram. A. 60° B. 65° C. 120° D. 125°
The following are the masses (in kg) of members in a club: 59, 44, 53, 49,

40, 48 and 50. Use the information to answer questions 39 and 40.

39. Calculate the mean mass. A. 40 kg B. 44 kg C. 50 kg D. 53 kg
40. Calculate the variance of the distribution. A. 35 B. 36 C. 40 D. 50
41. Two opposite sides of a rectangle are $(5x + 3)\text{ m}$ and $(2x + 9)\text{ m}$. If an adjacent side is $(6x - 7)\text{ m}$, find in m^2 , the area of the rectangle. A. 45 B. 65 C. 125 D. 165
42. A die is tossed once. Find the probability of getting a prime number. A. $1/2$ B. $1/6$ C. $1/3$ D. $2/3$
43. The area of a sector of a circle with radius 7 cm is 51.3 cm^2 . Calculate, correct to the nearest whole number, the angle of the sector. [Take $\pi = 22/7$]. A. 60° B. 120° C. 150° D. 180°
44. A cliff on the bank of a river is 87 m high. A boat on the river is 22 m away from the foot of the cliff. Calculate, correct to the nearest degree, the angle of depression of the boat from the top of the cliff. A. 76° B. 64° C. 36° D. 24°



NOT DRAWN TO SCALE

In the diagram \overline{TU} is a tangent to the circle $SPQR$ at P . If $\angle PTS = 44^\circ$ $\angle SQP = 35^\circ$, find $\angle PST$.

- A. 101° B. 125° C. 130° D. 135°
46. The probability that Amaka will pass an examination is $3/7$ and that Bala will pass is $4/9$. Find the probability that both will pass the examination. A. $2/21$ B. $4/21$ C. $5/21$ D. $9/21$
47. Which of the following points lies on the line $3x - 8y = 11$? A. $(1, 1)$ B. $(1, -1)$ C. $(-1, 1)$ D. $(-1, -1)$
48. Find the range of the following set of numbers: 28, 29, 39, 38, 33, 37, 26, 20, 15 and 25. A. 22 B. 24 C. 25 D. 27
49. The fourth and eighth terms of an Arithmetic Progression are 16 and 40 respectively. Find the common difference. A. -6 B. 6 C. -2 D. 2

50. For what values of y is $\frac{y+2}{8y^2-10y+3}$ not defined?

- A. $-\frac{3}{4}, -\frac{1}{2}$ B. $-\frac{3}{4}, \frac{1}{2}$
C. $\frac{3}{4}, -\frac{1}{2}$ D. $\frac{3}{4}, \frac{1}{2}$

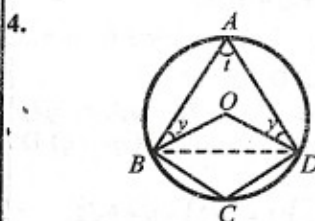
2024 THEORY QUESTIONS PAPER SECTION A

1. The time (t) taken to buy fuel at a filling station varies directly as the number of vehicles (V) in a queue and varies

inversely as the number of pumps (P), available at the station. In a station with 5 pumps, it took 10 minutes to fuel 20 vehicles. Find the;
(a) relationship between t , P and V ;
(b) time it takes to fuel 50 vehicles at a station with 2 pumps;
(c) number of pumps required to fuel 40 vehicles in 20 minutes.

2. A car travelled at a distance of $(2x + 13)\text{ km}$ at 67.5 km/h and $(5x - 20)\text{ km}$ at 72 km/h . If the total time for the entire journey was 90 minutes, find the value of x .

3. A circular floor of a building is to be tiled with ceramic tiles each of side 40 cm . If the perimeter of the floor is 66 m , calculate, correct to the nearest whole number, the number of tiles required to completely tile the floor. [Take $\pi = 22/7$].



NOT DRAWN TO SCALE

In the diagram, $ABCD$ is a circle O . The quadrilateral $OBOD$ is a rhombus such that $\angle ADO = \angle OBA = y$ and $\angle BAD = t$. Find;

- (a) the value of t ;
(b) the value of y ;
(c) $\angle ADC$.
5. A basket contains 3 gold-plated marbles, 4 diamond marbles and some silver marbles, all of the same size and shape. Two marbles were drawn from the basket at random one after the other without replacement. If the probability that the two marbles were all silver is $1/15$, find the number of silver marbles.

SECTION B

Given that $(x + 2)$, $(4x + 3)$ and $(7x + 24)$ are consecutive terms of a Geometric Progression ($G.P.$), find the;

- (a) value of x ;
(b) common ratio.

Age	5	6	7	8	9	10
Frequency	2	$2x - 1$	$y + 2$	4	2	$y - 1$

The table shows the ages of 20 children in a household.

Given that $x : y = 1 : 2$, find the

- (a) values of x and y ;
(b) means age of the children
8. Two observers Abu and Badu, 46 m apart, observe a bird on a vertical pole from the same side of the bird. The

angles of elevation of the bird from Abu's and Badu's eye are 40° and 48° respectively. If at the foot of the pole, Abu and Badu are on the same horizontal;

- (a) illustrate the information in a diagram;
(b) calculate, correct to one decimal place, the height of the pole.

9. The diameter of a circle centre O is 26 cm. If a chord \overline{PQ} is drawn such that it is 5 cm from O to the centre of the chord, calculate, correct to the nearest whole number, the:

- (a) $\angle POQ$
(b) Area of the minor segment formed by the chord \overline{PQ} . [Take $\pi = 22/7$].

- 10(a) In a man's will, he gave $2/5$ of the total acres of his cocoa farm to the wife and $1/3$ of what is left to the family. The rest of the farm was to be shared amongst his three children in the ratio $3 : 5 : 2$. Given that, the child who had the least share received 8 acres, calculate the:

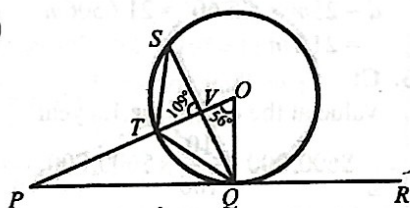
- (i) total acres the man left;
(ii) number of acres the wife received.

- (b) The list price of a Television set is \$1,600.00. It can be purchased by a deposit of \$400.00 and the rest of the amount paid by 12 monthly installment at 25 % per annum simple interest. If the Television set is purchased by installment, find the total cost.

- 11(a) Find the equation of the line that passes through the origin and the point of intersection of the lines $x + 2y = 7$ and $x - y = 4$

- (b) The ratio of an interior angle to an exterior angle of a regular polygon is 4 : 1. Find the:
(i) number of sides;
(ii) value of the exterior angle;
(iii) sum of the interior angles of the polygon.

12(a)

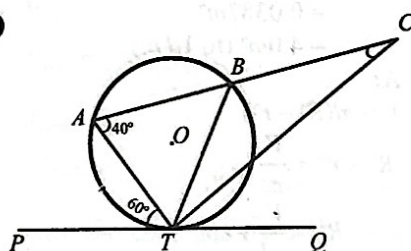


NOT DRAWN TO SCALE

In the diagram \overline{PR} is a tangent to the circle centre O at Q . $\angle POQ = 56^\circ$ and \overline{PO} intersects \overline{SO} at V such that $\angle SVP = 109^\circ$. Calculate:
(i) $\angle TQP$; (ii) $\angle QTS$.

(b) Simplify: $\frac{2n^2 - 3n - 2}{2n^2 + 3n + 1} \times \frac{n^2 - 1}{n^2 - 4}$

13(a)



NOT DRAWN TO SCALE

In the diagram ABT is a circle centre O . \overline{PQ} is a tangent to the circle at T and ABC is a straight line. \overline{TC} bisects $\angle BTQ$, $\angle BAT = 44^\circ$ and $\angle PTA = 60^\circ$. Find $\angle ACT$.

- (b) The circumference of the base of a cylindrical tank is 11 m. The height of the tank is 3 m more than 6 times the base radius. Calculate the:
(i) radius; (ii) height;
(iii) volume of the tank

2024 WASSCE MATHS (OBJECTIVE)

1. C:
 $3.4 \times 10^{-5} \times 7.1 \times 10^8 = (3.4 \times 7.1) \times (10^{-5} \times 10^8)$
 $= 24.14 \times 10^{-5+8}$
 $= 24.14 \times 10^3$
 $= 2.414 \times 10^1 \times 10^3$
 $= 2.414 \times 10^4$

2. B:
 $P\{p : 1 < p < 20\}$
Thus, $P = \{2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19\}$
 $R = \{r : 0 \leq 25, r \text{ is a multiple of } 4\}$
Then, $R = \{0, 4, 8, 12, 16, 20, 24\}$
 $\therefore P \cap R = \{4, 8, 12, 16\}$

3. C:
 $T_n = 29, a = 2, d = 3, n = ?$
 $T_n = a + (n - 1)d$
 $29 = 2 + (n - 1)3$
 $29 = 2 + 3n - 3; 29 = 3n - 1$
 $3n = 30, n = 30/3 = 10$

4. D:
 $\log_a^x + \log_a^y = 3$
Recall that $\log_a^P + \log_a^Q = \log_a^{PQ}$.
Then $\log_a^{xy} = 3$

Also, recall that if
 $\log_a^P = m, P = a^m$.

Thus, $xy = a^3$

5. A:
Method 1
 $(2p - q)^2 = 4p^2 - 4pq + q^2$
 $(p + q)^2 = p^2 + 2pq + q^2$
then,
 $(2p - q)^2 - (p + q)^2$

$$= 4p^2 - 4pq + q^2 - (p^2 + 2pq + q^2)$$

$$= 4p^2 - 4pq + q^2 - p^2 - 2pq - q^2$$

$$= 3p^2 - 6pq$$

$$= 3p(p - 2q)$$

Method 2

Using the approach of difference of two squares:

$$(2p - q)^2 - (p + q)^2$$

$$= (2p - q + p + q)(2p - q - (p + q))$$

$$= 3p(2p - q - p - q)$$

$$= 3p(p - 2q)$$

6. A:

$$(3 - 4\sqrt{2})(1 + 3\sqrt{2}) = a + b\sqrt{2}$$

$$3 + 9\sqrt{2} - 4\sqrt{2} - (4\sqrt{2} \times 3\sqrt{2}) = a + b\sqrt{2}$$

$$3 + 5\sqrt{2} - (4 \times 3 \times 2) = a + b\sqrt{2}$$

$$3 + 5\sqrt{2} - (12 \times 2) = a + b\sqrt{2}$$

$$3 + 5\sqrt{2} - 24 = a + b\sqrt{2}$$

$$-21 + 5\sqrt{2} = a + b\sqrt{2}$$

Comparing both sides, we have:

$$a = -21, b = 5$$

7. D:

Simple Interest = Amount - Principal
 $= \$ (2,031.25 - 1,250)$
 $= \$ 781.25$

$$I = \frac{PRT}{100}$$

$$781.25 = \frac{1250 \times 12.5 \times t}{100}$$

$$t = \left(\frac{781.25 \times 100}{1250 \times 12.5} \right) \text{ yrs}$$

$$= 25 \text{ yrs}$$

8. D:

$$\log_3^{(2x-1)} = 5$$

If $\log_a^P = m, P = a^m$

Now that
 $\log_3^{(2x-1)} = 5, 2x - 1 = 3^5$
 $2x - 1 = 243$
 $2x = 244,$
 $x = \frac{244}{2} = 122$

9. B:

Since there is compounding effect, we can simply use the approach of compound interest.

P_0 = Original population, P_n = Population after n years

$$P_n = P_0 \left(1 + \frac{r}{100} \right)^n$$

$$= 3000 \left(1 + \frac{3}{100} \right)^3$$

$$= 3000(1.03)^3$$

$$= 3278$$

10. A:

Error #570 - #540 = #30

$$\begin{aligned}\% \text{ error} &= \frac{\text{Error}}{\text{Actual value}} \times 100\% \\ &= \frac{30}{570} \times 100\% \\ &= \left(\frac{100}{19}\right)\% = 5\frac{5}{19}\%\end{aligned}$$

11. A:

Method 1

$$\text{Int.} + \text{Ext.} = 180^\circ$$

So, if an interior angle is 168° ,
the exterior angle $= 180^\circ - 168^\circ$
 $= 12^\circ$

Generally, the size of the exterior angle of a regular polygon of n sides

$$= \frac{360^\circ}{n}$$

Thus,

$$n = \frac{360^\circ}{12^\circ} = 30$$

Method 2

Sum of interior angles of a polygon
 $= (n-2)180^\circ$

Now that the polygon is regular, each interior angle

$$\frac{(n-2)180}{n}$$

As each interior angle is given here as 168° , we have:

$$168 = \frac{(n-2)180}{n}$$

$$168n = (n-2)180$$

$$168n = 180n - 360$$

$$12n = 360$$

$$n = \frac{360}{12} = 30$$

12. C:

$$3x - 2y = -5 \dots (i)$$

$$x + 2y = 9 \dots (ii)$$

Add (i) and (ii)

$$3x + x + (-2y + 2y) = -5 + 9$$

$$4x = 4, x = 1$$

put $x = 1$ into (ii)

$$1 + 2y = 9, 2y = 9 - 1 = 8, y = 4$$

then,

$$\frac{x-y}{x+y} = \frac{1-4}{1+4} = \frac{-3}{5}$$

13. C:

$W \propto M$ and $W \propto 1/P$

$$\text{then, } W = k_1 M + \frac{k_2}{P}$$

14. C:

Curved surface area of a cylinder $= 2\pi rh$

Area of one closed end $= \pi r^2$

Then, total surface area $= 2\pi rh + \pi r^2$
 $= \pi r(2h + r)$

$$r = 0.245m, h = 2.5m$$

then,

$$\begin{aligned}T.S.A. &= \frac{22}{7} \times 0.245 [2(2.5) + 0.245] \\ &= 0.77(5.245) \\ &= 0.0387m^2 \\ &= 4.0m^2 \text{ (to 1 d.p.)}\end{aligned}$$

15. A:

$$V = \pi l(R^2 - r^2)$$

$$R^2 - r^2 = \frac{V}{\pi l}$$

$$R^2 = \frac{V}{\pi l} + r^2$$

$$R = \sqrt{\frac{V}{\pi l} + r^2}$$

16. C:

The contrapositive statement of $p \rightarrow q$ is $\sim q \rightarrow \sim p$. It is the converse of the inverse.

17. D:

Let the number added be x

$$\frac{1+x}{8+x} = \frac{1}{2}$$

$$8+x = 2(1+x)$$

$$8+x = 2+2x$$

$$2x-x = 8-2$$

$$x = 6$$

18. A:

Total ratio $= 5 + 3 + 7 = 15$

$$\text{then, Justina's share} = \frac{60}{15} \times 3 = 12$$

19. A:

$$\text{Sum of roots} = \frac{2}{3} + (-1) = -\frac{1}{3}$$

$$\text{Product of roots} = \frac{2}{3} \times (-1) = -\frac{2}{3}$$

$$x^2 - (\text{sum of roots})x + \text{product of roots} = 0$$

$$x^2 - (-1/3)x + (-2/3) = 0$$

$$x^2 + \frac{1}{3}x - \frac{2}{3} = 0$$

Multiply through by 3

$$3x^2 + x - 2 = 0$$

20. A:

Perimeter of a rectangle

$$= 2(L + B)$$

$$44m = 2(L + B)$$

So, $L + B = 22$. Since $L : B = 7 : 4$

$$\frac{L}{B} = \frac{7}{4}, L = \frac{7B}{4}$$

Thus,

$$\frac{7B}{4} + B = 22$$

$$\frac{7B + 4B}{4} = 22$$

$$11B = 88$$

$$B = \frac{88}{11} = 8m$$

21. B:

Since $\overline{MN} \parallel \overline{KL}$, $\triangle LXX$ are similar tri-

angles.

The ratio of the areas of two similar triangles equals the square of the ratio of their corresponding sides.

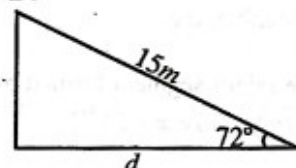
Then,

$$\frac{\text{Area of } \triangle MXN}{\text{Area of } \triangle LXX} = \left(\frac{12}{9}\right)^2$$

$$\frac{16cm^2}{\text{Area of } \triangle LXX} = \frac{144}{81}$$

$$\begin{aligned}\text{Thus, area of } \triangle LXX &= \frac{16cm^2 \times 81}{144} \\ &= 9cm^2\end{aligned}$$

22. D:



$$\cos 72^\circ = \frac{d}{15m}$$

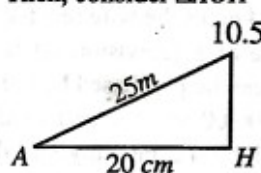
$$d = (15 \cos 72^\circ)m = 4.63m$$

23. A:

Since \overline{OH} bisects \overline{AB} ,

$$\overline{AH} = \overline{HB} = \frac{40cm}{2} = 20cm$$

Then, consider $\triangle AOH$



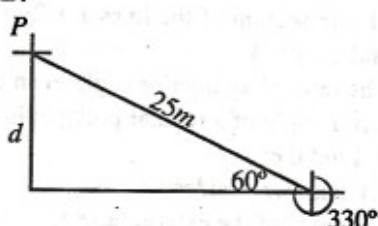
$$\overline{OH}^2 = 25^2 - 20^2$$

$$= 625 - 400$$

$$= 225$$

$$\overline{OH} = \sqrt{225} = 25cm$$

24. B:



$$\sin 60^\circ = \frac{d}{25m}$$

$$\begin{aligned}d &= 25m \times \sin 60^\circ = 21.6506m \\ &= 21.7m\end{aligned}$$

25. C:

Value at the end of the 1st year

$$\$600,000 - \frac{10}{100} \times \$600,000$$

$$= \$600,000 - \$60,000 = \$540,000$$

Value at the end of the 2nd year

$$= \$540,000 - \frac{10}{100} \times \$540,000$$

$$= \$540,000 - \$54,000 = \$486,000$$

26. B:

$$L = 15 \text{ cm}, B = 8 \text{ cm}, H = ?$$

$$V_{\text{cuboid}} = LBH$$

$$1560 \text{ cm}^3 = 15 \text{ cm} \times 8 \text{ cm} \times H$$

$$H = \left(\frac{1560}{15 \times 8} \right) \text{ cm} = 13 \text{ cm}$$

Surface area of a cuboid

$$= 2(LB + BH + LH)$$

$$= 2[(15 \times 8) + (8 \times 13) + 15 \times 13]$$

$$= 2(120 + 104 + 195)$$

$$= 2(419) = 838 \text{ m}^2$$

27. A:

$$6244_x - 1621_x = 4323_x$$

Let's convert all to base 10 and operate accordingly.

$$6^3 2^2 4^1 4^0 - 1^3 6^2 2^1 1^0 = 4^3 3^2 2^1 3^0$$

$$6x^3 + 2x^2 + 4x + 4x^0 - (x^3 + 6x^2 + 2x + 1x^0)$$

$$= 4x^3 + 3x^2 + 2x + 3x^0$$

$$6x^3 + 2x^2 + 4x + 4 - x^3 - 6x^2 - 2x - 1$$

$$= 4x^3 + 3x^2 + 2x + 3$$

$$5x^3 - 4x^2 + 2x + 3 = 4x^3 + 3x^2 + 2x + 3$$

$$5x^3 - 4x^2 + 2x + 3 - 4x^3 - 3x^2 - 2x - 3 = 0$$

$$x^2 - 7x^2 = 0$$

$$x^2(x - 7) = 0$$

$$x^2 = 0, x = 0 \text{ (which is inadmissible)}$$

OR

$$x - 7 = 0, x = 7$$

$$\text{thus, } x = 7$$

28. B:

$$27x^2 - 48y^2 = 3(9x^2) - 3(16y^2)$$

$$= 3(3x^2) - 3(4y^2)$$

$$= 3[(3x)^2 - (4y)^2]$$

$$= 3[(3x + 4y)(3x - 4y)]$$

29. C:

$$\frac{x-3}{4} + \frac{x+1}{8} \geq 2$$

Multiply through by 8

$$8\left(\frac{x-3}{4}\right) + 8\left(\frac{x+1}{8}\right) \geq 8(2)$$

$$2(x-3) + x+1 \geq 16$$

$$2x - 6 + x + 1 \geq 16$$

$$3x - 5 \geq 16$$

$$3x \geq 21$$

$$x \geq 7$$

30. C:

$$R\hat{Q}S + Q\hat{R}S + R\hat{S}Q = 180^\circ$$

$$52^\circ + 16^\circ + R\hat{S}Q = 180^\circ$$

$$R\hat{S}Q = 180^\circ - 52^\circ - 16^\circ = 112^\circ$$

$$y = R\hat{S}Q \text{ (exterior angle of a cyclic quadrilateral)}$$

$$\text{thus, } y = 112^\circ$$

31. B:

$$K\hat{G}L = 87^\circ \text{ (Exterior angle of a cyclic quadrilateral)}$$

Now consider ΔKGL

$$K\hat{G}L + GLK + LKG = 180^\circ$$

$$87^\circ + x + 38^\circ = 180^\circ$$

$$125^\circ + x = 180^\circ$$

$$x = 180^\circ - 125^\circ$$

$$= 55^\circ$$

32. B:

$$V_{\text{cone}} = \frac{1}{3} \pi r_{\text{cone}}^2 h_{\text{cyl.}}$$

$$R_{\text{cone}} = 2r_{\text{cyl.}}$$

$$\text{Then, } V_{\text{cone}} = \frac{1}{3} \times \pi \times (2r_{\text{cyl.}})^2 \times h_{\text{cone}}$$

since the cone and the cylinder have equal volume, we have;

$$V_{\text{cone}} = V_{\text{cylinder}}$$

$$\frac{1}{3} \times \pi \times (2r_{\text{cyl.}})^2 \times h_{\text{cone}} = \pi r_{\text{cyl.}}^2 \times h_{\text{cyl.}}$$

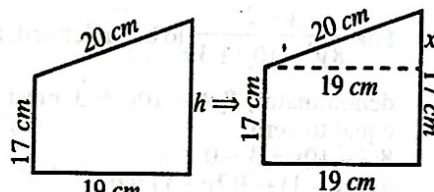
$$\frac{1}{3} \times 4 r_{\text{cyl.}}^2 \times h_{\text{cone}} = r_{\text{cyl.}}^2 \times h_{\text{cyl.}}$$

$$\text{so, } \frac{4}{3} h_{\text{cone}} = h_{\text{cyl.}}$$

$$\text{then, } \frac{h_{\text{cyl.}}}{h_{\text{cone}}} = \frac{4}{3}$$

$$\text{So, } h_{\text{cyl.}} : h_{\text{cone}} = 4 : 3$$

33. C:



$$20^2 = 19^2 + x^2$$

$$x = \sqrt{20^2 - 19^2}$$

$$= \sqrt{400 - 361}$$

$$= \sqrt{39}$$

$$= 6.245 \text{ m}$$

As can be seen,

$$h = (x + 17) \text{ m}$$

$$= (6.245 + 17) \text{ m}$$

$$= 23.245 \text{ m}$$

$$= 23 \text{ m (to the nearest whole number)}$$

34. C:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Thus,

$$-4 = \frac{y - (-8)}{1 - 2}$$

$$-4 = \frac{y + 8}{-1}$$

$$y + 8 = 4$$

$$y = 4 - 8$$

$$= -4$$

35. C:

$$X\hat{W}Y = Z\hat{Y}W = 44^\circ \text{ (Alternate } \angle\text{s)}$$

Now consider ΔWTX

$$\hat{W} + \hat{T} + \hat{X} = 180^\circ$$

$$\hat{W} + \hat{T} + \hat{X} = 44^\circ$$

$$\hat{X} = W\hat{X}Z = 50^\circ$$

$$\hat{T} = W\hat{T}X$$

So,

$$44^\circ + \hat{T} + 50^\circ = 180^\circ$$

$$94^\circ + \hat{T} = 180^\circ$$

$$\hat{T} = 180^\circ - 94^\circ$$

$$= 86^\circ$$

36. D:

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

$$B = L - 7. \text{ Then,}$$

$$90 = 2(L + L - 7)$$

$$90 = 2(2L - 7)$$

$$2L - 7 = 45$$

$$2L = 45 + 7 = 52$$

$$L = \frac{52}{2} = 26 \text{ m}$$

37. D:

Sum of the interior angles of an n sided polygon

$$= (n - 2)180^\circ$$

For hexagon ($n = 6$), we have:

$$(6 - 2)180^\circ = 720^\circ$$

Since sum of four of those angles is 420° , sum of the remaining two

$$= 720^\circ - 420^\circ = 300^\circ$$

As those two remaining angles are equal, size of each of them

$$\frac{300^\circ}{2} = 150^\circ$$

38. C:

Since QR/MS ,

$$Q\hat{R}N = S\hat{R}R = 55^\circ \text{ (corresponding angles)}$$

$$60^\circ + x = 180^\circ \text{ (}\angle\text{s on a straight line)}$$

$$60^\circ + x = 180^\circ$$

$$x = 180^\circ - 60^\circ = 120^\circ$$

39. C:

$$\text{Mean } (\bar{x}) = \frac{\sum x}{n}$$

$$= \frac{59 + 44 + 53 + 57 + 49 + 40 + 48 + 50}{8}$$

40. A:

$$S^2 \text{ (variance)} = \frac{\sum f(x - \bar{x})^2}{\sum f}$$

x	$x - \bar{x}$	$(x - \bar{x})^2$	f	$f(x - \bar{x})^2$
59	9	81	1	81
44	-6	36	1	36
53	3	9	1	9
57	7	49	1	49
49	-1	1	1	1
40	-10	100	1	100
48	-2	4	1	4
50		0	1	0
			8	280

$$S^2 = \frac{280}{8} = 35$$

41. B:

Opposite sides of a rectangle are equal.

Then,

$$5x + 3 = 2x + 9, 5x - 2x = 9 - 3, 3x = 6$$

$$x = \frac{6}{3} = 2$$

Then, we have: $5x + 3 = 5(2) + 3 = 13$

Also, adjacent side,

$$6x - 7 = 6(2) - 7 = 5$$

Area of a rectangle

$$= L \times B$$

$$= (13 \times 5) m^2$$

$$= 65 m^2$$

42. A:

Possible outcomes = 1, 2, 3, 4, 5, 6

Prime outcomes = 2, 3, 5

Thus,

$$P_{\text{prime}} = \frac{3}{6} = \frac{1}{2}$$

43. B:

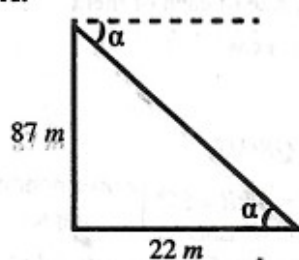
$$\text{Area of a sector} = \frac{\theta}{360} \times \pi r^2$$

$$51.3 = \frac{\theta}{360} \times \frac{22}{7} \times 7^2$$

$$\text{so, } \theta = \frac{51.3 \times 360 \times 7}{22 \times 7^2}$$

$$= 119.92^\circ = 120^\circ$$

44. A:



$$\tan \alpha = \frac{87}{22}$$

$$= 3.9545$$

$$\alpha = \tan^{-1} 3.9545$$

$$= 75.8^\circ = 76^\circ$$

45. A:

$$\widehat{SPT} = 35^\circ \left(\angle \text{ in the alternate segment} \right)$$

Now, consider ΔPST

$$\widehat{SPT} + \widehat{PTS} + \widehat{PST} = 180^\circ$$

$$35^\circ + 44^\circ + \widehat{PST} = 180^\circ$$

$$79^\circ + \widehat{PST} = 180^\circ$$

$$\widehat{PST} = 180^\circ - 75^\circ$$

$$= 101^\circ$$

46. B:

$$P_{\text{(Amaka passes)}} = \frac{3}{7}$$

$$P_{\text{(Bala passes)}} = \frac{4}{9}$$

The,

$$P_{\text{(both passes)}} = \frac{3}{7} \times \frac{4}{9}$$

$$= \frac{4}{21}$$

47. B:

If a point lies on a particular line, it

will satisfy the equation of the line.

Here, the equation of the line is $3x - 8y = 11$.

For (1, 1), we have $3(1) - (1) \neq 11$.

For (1, -1), we have $3(1) - 8(-1) = 3 + 8 = 11$.

Thus, the point (1, -1) lies on the line $3x - 8y = 11$.

48. B:

$$\text{Range} = \left(\begin{matrix} \text{maximum} \\ \text{value} \end{matrix} \right) - \left(\begin{matrix} \text{minimum} \\ \text{value} \end{matrix} \right)$$

$$= 39 - 15$$

$$= 24$$

49. B:

$$T_n = a + (n - 1)d$$

$$\text{So, } T_4 = a + 3d \text{ and } T_8 = a + 7d$$

Since T_4 and T_8 are respectively 16 and 40, we have:

$$a + 3d = 16 \dots\dots\dots (i)$$

$$a + 7d = 40 \dots\dots\dots (ii)$$

subtract (i) from (ii)

$$7d - 3d = 40 - 16$$

$$4d = 24$$

$$d = \frac{24}{4} = 6$$

50. D:

For $\frac{y+2}{8y^2-10y+3}$ to be undefined, the

denominator, $8y^2 - 10y + 3$ must be equal to zero:

$$8y^2 - 10y + 3 = 0$$

$$4y(2y - 1) - 3(2y - 1) = 0$$

$$(4y - 3)(2y - 1) = 0$$

Either $4y - 3 = 0$ or $2y - 1 = 0$.

thus, $\frac{3}{4}$ or $\frac{1}{2}$.

2024 MATHEMATICS THEORY SOLUTIONS

1. given $P_1 = 5$, $t_1 = 10$ min, $V_1 = 20$

$$\text{Using, } t \propto \frac{V}{P}$$

(a)

$$t \propto \frac{V}{P}$$

$$t = \frac{kV}{P}$$

$$k = \frac{tP}{V} = \frac{10 \times 5}{20} = \frac{5}{2}$$

$$\text{so that } t = \frac{\frac{5}{2}V}{P}$$

$$t = \frac{5V}{2P}$$

(b) To find t , given that, $V = 50$ and $P = 2$

$$t = \frac{5 \times 50}{2 \times 2} = \frac{250}{4} = 62.5 \text{ min}$$

(c) To find P when $V = 40$ and $t = 20$ min

$$P = \frac{5V}{2t} = \frac{5 \times 40}{2 \times 20} = 5 \text{ pumps}$$

2. Given:

distance, $s_1 = (2x + 13) \text{ km}$

speed, $v_1 = 67.5 \text{ km/hr}$

distance, $s_2 = (5x - 20) \text{ km}$

speed, $v_2 = 72 \text{ km/hr}$

since the speed is given in km/hr , it necessary to convert 90 min to hour.

$$90 \text{ min} = \frac{90}{60} \text{ hr} = 1\frac{1}{2} \text{ hr}$$

using speed, $v = \frac{\text{distance}}{\text{time}}$

$$\text{time, } t_1 = \frac{s_1}{v_1} = \frac{2x+13}{67.5}$$

$$\text{similarly, } t_2 = \frac{5x-20}{72}$$

$$\text{but } t_1 + t_2 = 1\frac{1}{2} \text{ hr (given)}$$

$$\Rightarrow \frac{2x+13}{67.5} + \frac{5x-20}{72} = \frac{3}{2} \text{ hr}$$

Multiply through by $(67.5)(72)$

$$72(2x+13) + 67.5(5x-20) = 7290$$

$$144x + 936 + 337.5x - 1350 = 7290$$

$$481.5x = 7704$$

$$x = 16$$

3. Given: dimension of tiles

$= 40 \text{ cm} \times 40 \text{ cm}$

perimeter of floor $= 66 \text{ m}$

perimeter of floor (circle) $= 2\pi r = 66 \text{ m}$

$$r = \frac{66}{2\pi} = \frac{66}{2 \times \frac{22}{7}}$$

$$r = \frac{66 \times 7}{44} = \frac{462}{44} = \frac{21}{2} \text{ cm}$$

Area of floor (circle)

$$= \pi r^2 = \frac{22}{7} \times \left(\frac{21}{2} \right)^2$$

$$= \frac{22}{7} \times \frac{21 \times 21}{2}$$

$$= 346.5 \text{ m}^2$$

Area of tile $= 0.4 \times 0.4$

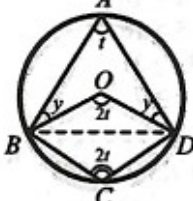
$$= 0.16 \text{ m}^2$$

No of tiles required

$$= \frac{346.5}{0.16} = 2165.625$$

$$\approx 2166$$

4.



(a) to find t

$$\angle BCD = \angle BOD = 2t \quad \left(\begin{matrix} \text{angle at the} \\ \text{centre} = 2\text{ce} \\ \text{that at the} \\ \text{circumference} \end{matrix} \right)$$

$$\angle BCD + \angle BAD = 180^\circ \quad \left(\begin{matrix} \text{opposite} \\ \text{angles of a} \\ \text{cyclic} \\ \text{quad. are} \\ \text{supplem-} \\ \text{entary} \end{matrix} \right)$$

$$2t + t = 180^\circ$$

$$3t = 180^\circ, t = \frac{180}{3} = 60^\circ$$

(b) To find the value of y

$$\angle BOD = 2t = 2 \times 60^\circ$$

$$= 120^\circ$$

$$\angle BOD = \angle ODB \text{ (equal radii)}$$

$$\Rightarrow \angle OBD + \angle ODB + 2t = 180^\circ \text{ (sum of } \angle\text{s in a } \Delta)$$

$$2\angle OBD + 2(60) = 180^\circ$$

$$\angle OBD = 30^\circ$$

$$\angle OBD = \angle ODB = 30^\circ$$

Consider ΔBAD

$$60 + (y + 30) + (y + 30) = 180 \text{ (sum of } \angle\text{s in a } \Delta)$$

$$60 + 30 + 30 + 2y = 180^\circ$$

$$2y = 180 - 120^\circ$$

$$2y = 60^\circ, y = 30^\circ$$

(c) To find $\angle ADC$

$$\angle OBD + \angle ODB + \angle BOD = 180^\circ$$

$$\Rightarrow 2\angle ODB = 180^\circ - \angle BOD$$

$$2\angle ODB = 180^\circ - 120^\circ$$

$$2\angle ODB = 60^\circ$$

$$2\angle ODB = 30^\circ$$

$$\angle ADC = \angle ADO + \angle ODB + \angle BDC$$

$$\angle ADC = 30^\circ + 30^\circ + 30^\circ = 90^\circ$$

5. gold marble	- 3
Diamond marble	- 4
Silver marble	- x
Total	$x + 7$

given:

$$P(\text{1st silver and second silver}) = \frac{1}{15}$$

$$P(\text{1st silver}) = \frac{x}{x+7}$$

$$P(\text{2nd silver}) = \frac{x-1}{6+x}$$

thus, $P(\text{1st silver and second silver})$

$$= \left(\frac{x}{x+7} \right) \left(\frac{x-1}{x+6} \right) = \frac{1}{15}$$

$$= \frac{x(x-1)}{(x+7)(x+6)} = \frac{1}{15}$$

$$\frac{x^2 - x}{x^2 + 13x + 42} = \frac{1}{15}$$

$$15x^2 - 15x = x^2 + 13x + 42$$

$$\Rightarrow 14x^2 - 28x - 42 = 0$$

divide through by 14

$$x^2 - 2x - 3 = 0$$

$$(x+1)(x-3) = 0$$

$$x = -1, 3$$

since number of silver marbles cannot be negative,

number of silver marbles = 3.

(a) To find x , given that $(x+2)$, $(4x+3)$ and $7x+24$ are consecutive terms of a G.P.

thus, $a = x+2$

$$r = \frac{4x+3}{x+2} = \frac{7x+24}{4x+3}$$

$$\Rightarrow (4x+3)(4x+3) = (x+2)(7x+24)$$

$$16x^2 + 24x + 9 = 7x^2 + 38x + 48$$

$$9x^2 - 14x - 39 = 0$$

$$(9x+13)(x-3) = 0$$

$$9x+13=0, x-3=0$$

$$x = \frac{-13}{9}, x = 3$$

(b) To find the value of the common ratio, r , when $x = -13/9$

$$r = \frac{4\left(\frac{-13}{9}\right) + 3}{\frac{-13}{9} + 2}$$

$$r = \frac{\frac{-52+27}{9}}{\frac{13+18}{9}} = \frac{-25}{5/9}$$

$$r = -5$$

when $x = 3$

$$r = \frac{4(3)+3}{3+2} = \frac{15}{5} = 3$$

$$\therefore r = -5 \text{ or } 3$$

7(a)

age(x)	5	6	7	8	9	10
freq. (f)	2	$2x-1$	$y+1$	4	2	$y-1$
$f(x)$	10	$12x-6$	$7y+7$	32	18	$10y-10$

given: $\Sigma f = 20$

$$\Rightarrow 2+2x-1+y+2+4+2+y-1 = 20$$

$$8+2x+2y = 20$$

$$2x+2y = 12$$

$$x+y = 6 \text{ (1)}$$

$$\text{also, } x:y = 1:2$$

$$\frac{x}{y} = \frac{1}{2}$$

$$x = \frac{y}{2} \text{ (2)}$$

substitute (2) into (1)

$$\frac{y}{2} + y = 6$$

$$\frac{y+2y}{2} = 6; 3y = 12, y = 4$$

$$x = \frac{y}{2} = \frac{4}{2} = 2$$

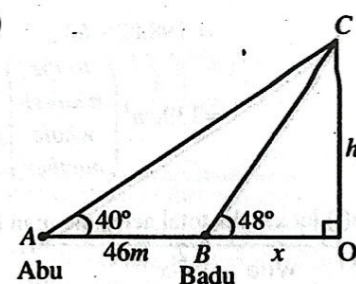
(b)

$$\text{mean } \bar{x} = \frac{\Sigma fx}{\Sigma f}$$

$$\bar{x} = \frac{(5 \times 2) + 6[2(2)-1] + 7(4+2) + (8 \times 4) + (9 \times 2) + 10(4-1)}{20}$$

$$= \frac{150}{20} = 7.5$$

8(a)



(b) let $|OB| = x$ and $|OC| = h$
from ΔOBC

$$\tan 48^\circ = \frac{h}{x}$$

$$h = x \tan 48$$

$$h = 1.1106x \text{ (1)}$$

from ΔAOC

$$\tan 40 = \frac{h}{46+x}$$

$$h = (\tan 40)(46+x)$$

$$h = 38.5986 + 0.8391x \text{ (2)}$$

equate (1) and (2)

$$1.1106x = 38.5986 + 0.8391x$$

$$0.2715x = 38.5986$$

$$x = \frac{38.5986}{0.2715}$$

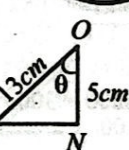
$$x = 142.1680$$

Height of pole

$$= 1.106 \times 142.1680$$

$$= 157.8918 = 157.9 \text{ m (1 d.p.)}$$

9(a)



$$\cos \theta = \frac{5}{13}$$

$$\theta = \cos^{-1}\left(\frac{5}{13}\right) = 67.38^\circ$$

$$\angle POQ = 2\theta = 2(67.38) = 134.76$$

$$\approx 135^\circ \text{ (to the nearest whole number)}$$

(b) Area of minor sector

$$POQ = \frac{\theta}{360} \times \pi r^2$$

$$= \frac{134.76}{360} \times \frac{22}{7} \times 13^2$$

$$= 198.82 \text{ cm}^2$$

By Pythagoras' theorem

$$|PN| = \sqrt{13^2 - 5^2} = 12 \text{ cm}$$

$$\text{area of } \Delta PQO = \frac{1}{2} b \times h$$

$$= \frac{1}{2} \times |PQ| \times |ON|$$

$$= \frac{1}{2} \times (12 \times 2) \times 5$$

$$12 \times 5 = 60 \text{ cm}^2$$

$$\left(\text{Area of minor segment} \right) = \left(\text{area of minor sector} \right) - \left(\text{area of triangle} \right)$$

$$= 198.82 - 60$$

$$= 139 \text{ cm}^2 \left(\begin{array}{l} \text{to the} \\ \text{nearest} \\ \text{whole} \\ \text{number} \end{array} \right)$$

10a(i) let x = the total acres the man left

$$\text{Wife} \rightarrow \frac{2}{5}x$$

$$\text{remainder} = x - \frac{2x}{5} = \frac{3x}{5}$$

$$\text{family} = \frac{1}{3} \left(\frac{3x}{5} \right) = \frac{x}{5}$$

$$\text{acres left} = \frac{3x}{5} - \frac{x}{5} = \frac{2x}{5}$$

total or sum of ratio
 $= 3 + 5 + 2 = 10$

Child with least share

$$\Rightarrow \frac{1}{10} \times \left(\frac{2x}{5} \right) = 8$$

$$\frac{2x}{25} = 8$$

$$x = \frac{8 \times 25}{2} = 100 \text{ acres}$$

(ii) Acres received by wife

$$= \frac{2}{5} \times 100$$

$$= 40 \text{ acres}$$

(b) List price \$1,600

deposit \$ 400.00

balance = \$ 1600 - \$400 = \$1200

Interest, $I = \frac{PRT}{100}$

$$I = \frac{1200 \times 25 \times 1}{100}$$

$$I = \$300$$

$$\therefore \text{Total cost} = 400 + 1200 + 300$$

$$= \$1,900.00$$

11(a) To get the coordinate of the point of intersection, we solve the two given equations simultaneously i.e.

$$x + 2y = 7 \dots\dots\dots (1)$$

$$x - y = 4 \dots\dots\dots (2)$$

$$3y = 3$$

$$y = 1$$

$$\text{and } x + 2y = 7$$

$$x = 7 - 2y$$

$$x = 7 - 2(1) = 5$$

$$(5, 1)$$

the line also passes through the origin, (0, 0)

gradient of the line

$$= \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - 0}{5 - 0} = \frac{1}{5}$$

thus, the equation of the required line is $y - y_1 = m(x - x_1)$

$$y - 0 = \frac{1}{5}(x - 0)$$

$$y = \frac{1}{5}(x) \text{ or } 5y - x = 0$$

b(i) Interior angle of a regular polygon

$$= \frac{(n-2) \times 180}{n}$$

$$\text{Exterior angle} = \frac{360}{n}$$

Ratio of the two

$$\Rightarrow \frac{(n-2) \times 180}{n} : \frac{360}{n} = 4$$

$$= \frac{(n-2) \times 180}{n} \div \frac{360}{n} = 4$$

$$= \frac{(n-2) \times 180}{\cancel{n}} \times \frac{\cancel{n}}{360} = 4$$

$$= \frac{(n-2) \times 180}{360} = 4$$

$$n - 2 = 8$$

$$n = 10$$

$$(ii) \text{ External angle} = \frac{360^\circ}{n}$$

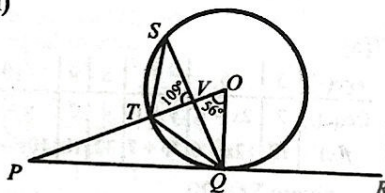
$$= \frac{360}{10} = 36^\circ$$

(iii) Sum of interior angles

$$= (n-2)180$$

$$= (10-2) \times 180 = 1440^\circ$$

12a(i)



(i) Since O is the centre

$$\angle OQT + \angle OTQ + 56^\circ = 180^\circ \left(\begin{array}{l} \text{sum of } \angle s \\ \text{in a } \triangle OTQ \end{array} \right)$$

$$\angle OQT = \angle OTQ \left(\begin{array}{l} \text{base } \angle s \text{ of} \\ \text{isosceles } \triangle \end{array} \right)$$

$$2\angle OQT + 56^\circ = 180^\circ$$

$$\angle OQT = \frac{180 - 56}{2} = 62^\circ$$

$$\angle OQP = 90^\circ \left\{ \begin{array}{l} \angle \text{ between tangent} \\ \text{and circle centre} \end{array} \right\}$$

$$\angle OQT + \angle TQP = \angle OQP$$

$$62^\circ + \angle TQP = 90^\circ$$

$$\angle TQP = 90 - 62 = 28^\circ$$

$$(ii) \angle TOQ = 2\angle TSQ \left\{ \begin{array}{l} \angle \text{ at centre is} \\ \text{twice } \angle \text{ at} \\ \text{circumference} \end{array} \right\}$$

$$56^\circ = 2\angle TSQ$$

$$\angle TSQ = \frac{56^\circ}{2} = 28^\circ$$

$$\angle QVO = 109^\circ = \angle TVS \left\{ \begin{array}{l} \text{vertically} \\ \text{opposite} \\ \text{angles} \end{array} \right\}$$

$$\angle VQO + \angle QVO + \angle VOQ = 180^\circ \left\{ \begin{array}{l} \text{sum} \\ \text{of } \angle s \\ \text{in a } \triangle \end{array} \right\}$$

$$\angle VQO + 109^\circ + 56^\circ = 180^\circ$$

$$\angle VQO = 180^\circ - 109^\circ - 56^\circ = 15^\circ$$

$$\angle OQT = \angle VQO + \angle TQS$$

$$\angle TQS = 62^\circ - 15^\circ = 47^\circ$$

$$\angle QTS + \angle TSQ + \angle TQS = 180^\circ \left\{ \begin{array}{l} \text{sum} \\ \text{of } \angle s \\ \text{in a } \triangle \end{array} \right\}$$

$$\angle QTS = 180^\circ - 28^\circ - 47^\circ = 105^\circ$$

(b) To simplify $\frac{2n^2 - 3n - 2}{2n^2 + 3nn + 1} \times \frac{n^2 - 1}{n^2 - 4}$

by factorization of the terms on the numerator and denominator, we obtain

$$\frac{(2n+1)(n-2)}{(2n+1)(n+1)} \times \frac{(n+1)(n-1)}{(n+2)(n-2)}$$

$$= \frac{n-1}{n+2}$$

13.

$$\angle BTQ = 44^\circ \left(\begin{array}{l} \angle \text{ in the} \\ \text{alternate} \\ \text{segment} \end{array} \right)$$

$$\angle ABT = 60^\circ \left(\begin{array}{l} \text{same} \\ \text{reason} \\ \text{as above} \end{array} \right)$$

$$\angle TBC + \angle ABT = 180^\circ \left(\begin{array}{l} \text{sum of } \angle s \\ \text{on a} \\ \text{straight} \\ \text{line} \end{array} \right)$$

$$\angle TBC = 180 - 60^\circ = 120^\circ$$

Since TC bisects $\angle BTQ$

$$\angle BTC = \angle CTQ = \frac{1}{2} \angle BTQ$$

$$= \frac{44}{2} = 22^\circ$$

$$\angle PTA + \angle BTA + \angle BTQ = 180^\circ \left(\begin{array}{l} \angle s \text{ on a} \\ \text{straight} \\ \text{line} \end{array} \right)$$

$$\angle BTA = 180 - (60 + 44)$$

$$\angle BTA = 180 - 104 = 76^\circ$$

and finally,

$$\angle BTC + \angle BTA + \angle BAT + \angle ACT = 180^\circ$$

$$22 + 76 + 44 + \angle ACT = 180^\circ$$

$$\angle ACT + 142 = 180^\circ$$

$$\angle ACT = 180 - 142 = 38^\circ$$

b(i) Circumference of a circle

$$= 2\pi r = 11$$

$$r = \frac{11}{2\pi} = \frac{11}{2 \times \frac{22}{7}} = \frac{77}{44}$$

$$r = \frac{7}{4} m$$

$$(ii) h = 3 + 6 \left(\frac{7}{4} \right) \text{ (given)}$$

$$h = 3 + \frac{21}{2} = \frac{27}{2} m$$

(iii) Volume = $\pi r^2 h$

$$= \frac{22}{7} \times \left(\frac{7}{4} \right)^2 \times \frac{27}{2}$$

$$= 129.9375$$

$$\approx 129.94 m^3 \text{ (2 d.p.)}$$