Mathematics (Basic)

Answers

2019-2020

Time Allowed : 3 hours **Maximum Marks : 80**

Section A

1. **Correct Answer: B**

intersecting or coincident If a pair of linear equations is consistent, then the lines represented by them are intersecting or coincident.

2. **Correct Answer: A**

$$\text{Distance} = \sqrt{(3-(3))^2 + (-2-2)^2}$$
$$= \sqrt{(3+3)^2 + (-4)^2}$$
$$= \sqrt{36+16}$$
$$= \sqrt{52}$$

3. **Correct Answer: C**

$$8\cot^2 A - 8\text{cosec}^2 A$$
$$= 8(\cot^2 A - \text{cosec}^2 A)$$
$$= 8 \times -1$$
$$= -8$$

4. **Correct Answer: C**

The total surface area of a frustum-shaped glass tumbler is $\frac{1}{3}\pi h(r_1^2 + r_2^2 + r_1 r_2)$ where radii $r_1 > r_2$.

5. **Correct Answer: D**

$120 = 20 \times 6$

$= 5 \times 4 \times 2 \times 3$

$= 5 \times 2^3 \times 3$

6. **Correct Answer: D**

The given equation is:

$4x^2 - 6x + 3 = 0$

Discriminant $= b^2 - 4ac$

Here, $b = -6, a = 4$, and $c = 3$

So, Discriminant $= (-6)^2 - 4 \times 4 \times 3$

$= 36 - 48 = -12$.

7.**Correct Answer: C**

$(3,-6)$ is the mid-point of the line segment joining $(0,0)$ and (x,y).

So, $\frac{(0+x)}{2} = 3$ or, $x = 6$

and $\frac{(0+y)}{2} = -6$ or, $y = -12$

8. **Correct Answer: D**

In the given figure, number of tangents parallel to tangent PQ is 1.

9. **Correct Answer: A**

Class	Frequency	Cumulative frequency
$0-5$	8	8
$5-10$	10	18
$10-15$	19	37
$15-20$	25	62
$20-25$	8	70
Sum:	70	

Sum of frequencies $(n)=70$

Middle observation $=\left(\left(\frac{n}{2}\right)+1\right)\text{th}$ observation

$=\left(\frac{70}{2}+1\right)\text{th}$ observation

$=36^{\text{th}}$ observation

36^{th} observation lies in class interval $10-15$. So, median class is $10-15$ and its upper limit is 15.

10. **Correct Answer: D**

The probability of an impossible event is 0.

Fill in the blanks in question numbers 11 to 15.

11. Secant

12. 1

$a(2)^2-2\times 2=0$

$\Rightarrow \quad 4a-4=0$

$\Rightarrow \quad a=1$

13. similar

14. $8:27$

$r_1 : r_2 = 2:3$

$$\frac{V_1}{V_2} = \frac{\frac{4}{3}\pi r_1^3}{\frac{4}{3}\pi r_2^3} = \frac{r_1^3}{r_2^3}$$

$$\frac{V_1}{V_2} = \frac{8}{27}$$

15. Collinear

16. $\tan 60° = \frac{20}{AB}$

$$\sqrt{3} = \frac{20}{AB}$$

$$AB = \frac{20}{\sqrt{3}}$$

So, the required distance is $\frac{20}{\sqrt{3}}\text{m}$.

17. $\tan 40° \times \tan 50°$

$= \tan(90° - 50°) \times \tan 50°$

$= \cot 50° \times \tan 50°$

$= 1 \quad (\because \tan\theta \cot\theta = 1)$

OR

$\cos A = \sin 42°$

$\Rightarrow \cos A = \sin(90° - 48°)$

$\Rightarrow \cos A = \cos 48°$

$\Rightarrow A = 48°$

18. All possible outcomes are HH, HT, TT, TH.

Probability of an event $= \frac{\text{Number of favourable outcomes}}{\text{Number of all possible outcomes}}$

Probability of getting head both the times $= \frac{1}{4}$

19. Height of the cone $= \sqrt{13^2 - 5^2}$

$= \sqrt{169 - 25}$

$= \sqrt{144}$

$= 12$

Therefore, the height of the cone is $12\,\text{m}$.

20. $-6, x, 8$ are in A.P.

$\Rightarrow 2x = -6 + 8$

$\Rightarrow 2x = 2$

$\Rightarrow x = 1$

OR

$-27, -22, -17, -12, \ldots$

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

$a_{11} = -27 + (11-1) \times 5$

$= -27 + 50$

$= 23$

Section B

21. $3x^2-4\sqrt{3x}+4=3x^2-2\sqrt{3x}-2\sqrt{3x}+4$

$=\sqrt{3}x\left(\sqrt{3x}-2\right)-2\left(\sqrt{3x}-2\right)$

$=\left(\sqrt{3x}-2\right)\left(\sqrt{3x}-2\right)$

So, the roots of the equation are the values of x for which

$\left(\sqrt{3}x-2\right)\left(\sqrt{3}x-2\right)=0$

Now, $\sqrt{3}x-2=0$ for $x=\frac{2}{\sqrt{3}}$

So, this root is repeated twice, one for each repeated factor $\sqrt{3}x-2$.

Therefore, the roots of $3x^2-4\sqrt{3}x+4$ are $\frac{2}{\sqrt{3}},\frac{2}{\sqrt{3}}$.

22. If the number 6^n, for any n, were to end with the digit zero, then it would be divisible by 5.

That is, the prime factorisation of 6^n would contain the prime 5. This is not possible

$\because 6^n=(2\times 3)^n$

So, the prime numbers in the factorisation of 6^n are 2 and 3.

So, the uniqueness of the Fundamental Theorem of Arithmetic guarantees that there are no other primes in the factorisation of 6^n .

So, there is no natural number n for which 6^n ends with the digit zero.

OR

We have,

$150=5^2\times 3\times 2$

and, $200=5^2\times 2^3$

Here, $2^3, 3^1$ and 5^2 are the greatest powers of the prime factors $2, 3$ and 5 respectively involved in the two numbers.

So, $\text{LCM}(150, 200) = 2^3 \times 3^1 \times 5^2 = 600$

23. We have

$\tan(A+B) = \sqrt{3}$

or $\tan(A+B) = \tan 60°$

or $A+B = 60° \quad ...(1)$

Again, we have

$\tan(A-B) = \frac{1}{\sqrt{3}}$

or $\tan(A-B) = \tan 30°$

or $A-B = 30° \quad ...(2)$

On adding equations (1) and (2), we get

$2A = 90°$

or $A = 45°$

On putting this value of A in equation (1), we get

$B = 15°$

24. In ΔABC and ΔXZY,

$\frac{BC}{ZY} = \frac{6}{12}$

$= \frac{1}{2}$

$\frac{AC}{XY} = \frac{2\sqrt{3}}{4\sqrt{3}}$

$= \frac{1}{2}$

$\frac{AB}{XZ} = \frac{3}{6}$

$= \frac{1}{2}$

Ratios of the corresponding sides of the given pair of triangles are equal.

i.e., $\frac{BC}{YZ} = \frac{AC}{XY} = \frac{AB}{XZ} = \frac{1}{2}$

Therefore, by SSS similarity criterion, $\Delta ABC \sim \Delta XZY$.

The corresponding angles are equal in ΔABC

and ΔXZY . i.e.,

$\angle A = \angle X = 80°$

$\angle B = \angle Z = 60°$

and

$\angle C = \angle Y$

In ΔABC ,

$\angle A + \angle B + \angle C = 180°$

$\Rightarrow 80° + 60° + \angle C = 180°$

$\Rightarrow \quad \angle C = 180° - 140°$

$\Rightarrow \quad \angle C = 40°$

$\Rightarrow \quad \angle Y = 40°$

25. Number of defective bulbs $=14$

Number of good bulbs $=98$

Total number of outcomes $=98+14=112$

Probability of getting a good bulbs

$$=\frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$$

$$=\frac{98}{112}$$

$$=\frac{7}{8}$$

26.

Classes	$5-15$	$15-25$	$25-35$	$35-45$
Frequency	2	4	3	1

Here, we observe that class marks and frequencies are small quantities.

So, we use direct method to compute the mean and proceed as below.

Classes	**Frequency** (f_i)	x_i	$f_i x_i$
$5-15$	2	10	20
$15-25$	4	20	80
$25-35$	3	30	90
$35-45$	1	40	40
Total	10		230

$$\text{Mean}, \bar{x}=\frac{\sum f_i x_i}{\sum f_i}$$

$$=\frac{230}{10}$$

$$=23$$

Therefore, mean for the following distribution is 23.

OR

Expenditure	200 – 400	400 – 600	600 – 800	800 – 1000	1000 – 1200
Number of employees	21	25	19	23	12

From the given data, we have

$l = 400,\ f_1 = 25,\ f_0 = 21,\ f_2 = 19, h = 200$

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

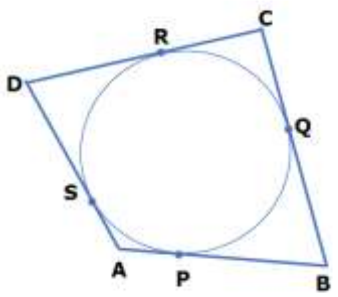
$$= 400 + \left(\frac{25 - 21}{2 \times 25 - 21 - 19}\right) \times 200$$

$$= 480$$

$\therefore$ Mode of the given data is 480.

Section C

27.



In the given figure, quadrilateral $ABCD$ is circumscribing the given circle and its sides are touching the circle at P, Q, R and S.

We have to prove that

$AB + CD = AD + BC$

We know that lengths of tangents drawn from a point to a circle are equal.

Therefore, from figure, we have

$DR = DS, CR = CQ, AS = AP, BP = BQ$

Now,

L.H.S. $= AB+CD=(AP+BP)+(CR+DR)$

$=(AS+BQ)+(CQ+DS)$

$= AS+DS+BQ+CQ$

$= AD+BC$

$=$ R.H.S

28. Let the larger number be y and the smaller number be x.

According to question,

$y-x=26 \quad \ldots(1)$

and $y=3x+4 \quad \ldots(2)$

Substituting the value of y from equation (2) in equation (1), we get

$3x+4-x=26$

or $2x=26-4$

or $2x=22$

or $x=11$

Putting this value of x in equation (1), we get

$y-11=26$

or $y=26+11=37$

Hence, the numbers are 11 and 37.

OR

$\frac{2}{x}+\frac{3}{y}=13$ and $\frac{5}{x}-\frac{4}{y}=-2$

Let $\frac{1}{x}=p$ and $\frac{1}{y}=q$

then given equations can be written as:

$2p+3q=13$

$2p+3q-13=0 \quad ...(1)$

and

$5p-4q=-2$

$5p-4q+2=0 \quad ...(2)$

Using cross-multiplication method, we get

$$\frac{p}{6-52}=\frac{q}{-65-4}=\frac{1}{-8-15}$$

$$\Rightarrow \frac{p}{-46}=\frac{q}{-69}=\frac{1}{-23}$$

$$\Rightarrow \frac{p}{-46}=\frac{1}{-23} \text{ and } \frac{q}{-69}=\frac{1}{-23}$$

$$\Rightarrow p=\frac{-46}{-23} \text{ and } q=\frac{-69}{-23}$$

$$\Rightarrow p=2 \text{ and } q=3$$

$$\Rightarrow \frac{1}{x}=2 \text{ and } \frac{1}{y}=3$$

$$\Rightarrow x=\frac{1}{2} \text{ and } y=\frac{1}{3}$$

29. Let us assume that $\sqrt{3}$ is rational.

So we can find integers r and $s(\neq 0)$ such that $\sqrt{3}=\frac{r}{s}$.

Suppose r and s have a common factor other than 1.

Then we divide r and s by the common factor and get $\sqrt{3}=\frac{a}{b}$

where a and b are coprime.

So, $\sqrt{3}b=a$

Squaring on both sides, we get

$3b^2 = a^2$

Therefore,

a^2 is divisible by 3, and so is also divisible by 3.

So, we can write $a = 3c$ for some integer c.

Now,

$3b^2 = a^2$

$\Rightarrow 3b^2 = 9c^2$

$\Rightarrow b^2 = 3c^2$

This means that b^2 is divisible by 3, and so b is also divisible by 3.

Therefore,

a and b have at least 3 as a common factor.

But this contradicts the fact that a and b are coprime. So, our assumption that $\sqrt{3}$ is a rational is wrong.

Hence, $\sqrt{3}$ is an irrational number.

30. (i) From the given figure, the coordinates of points A, B, C and D can be written as below:

$A(2,2), B(5,4), C(7,7)$ and $D(4,5)$.

(ii) We know that a quadrilateral is a parallelogram if its opposite sides are equal.

Now, using distance formula, we will find the length of each side of the quadrilateral $ABCD$.

$AB = \sqrt{(5-2)^2 + (4-2)^2} = \sqrt{9+4} = \sqrt{13}$

$BC = \sqrt{(7-5)^2 + (7-4)^2} = \sqrt{4+9} = \sqrt{13}$

$CD = \sqrt{(4-7)^2 + (5-7)^2} = \sqrt{9+4} = \sqrt{13}$

$DA = \sqrt{(2-4)^2 + (2-5)^2} = \sqrt{4+9} = \sqrt{13}$

We see that sides AB, BC, CD and DA are equal in lengths, Therefore, quadrilateral $ABCD$ is a parallelogram.

31. Here, $S_{14} = 1050, a = 10$

We have to find a_{21}.

We know that sum of first n terms of an AP is given by

$S_n = \frac{n}{2}[2a + n - 1d]$

So, $S_{14} = \frac{14}{2} 2\times 10 + 13\times d$

$1050 = 7(20 + 13d)$

or $d = 10$

We know that

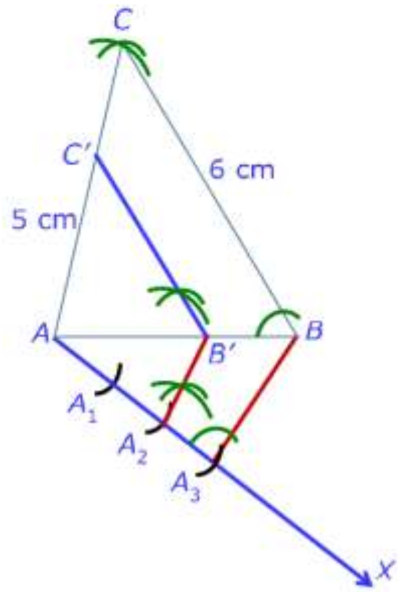
$a_n = a + (n-1)d$

So, $a_{21} = 10 + (21-1)10$

$= 10 + 20\times 10$

$= 210$

32.



Step 1: Draw a line segment $AB = 4\text{cm}$. Taking point A as centre, draw an arc of 5cm radius. Again, taking point B as centre, draw an arc of 6cm. These arcs intersect each other at point C. So, we have $AC = 5\text{cm}$ and $BC = 6\text{cm}$. ΔABC is the required triangle.

Step 2: Draw a ray AX making an acute angle with line AB on the opposite side of vertex C.

Step 3: Locate 3 points A_1, A_2, A_3 on AX such that

$AA_1 = A_1A_2 = A_2A_3$.

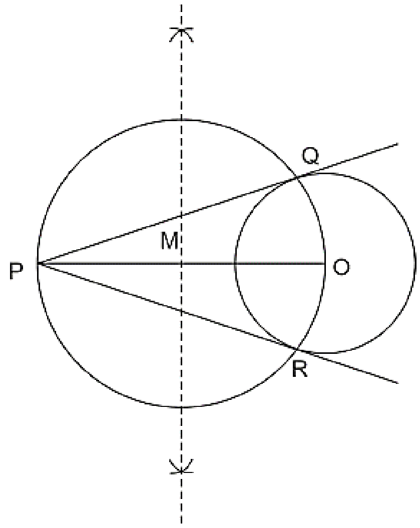
Step 4: Join the points B and A_3.

Step 5: Through the point A_2, draw a line parallel to BA_3 intersecting AB at point B'.

Step 6: Draw a line through B' parallel to the line BC to intersect AC at C'.

The required triangle is $\Delta AB'C'$.

OR



Steps of Construction :

Step 1: Draw a circle of radius 2.5cm with centre at point O.

Locate a point P, at a distance of 8cm from O, and join O and P.

Step 2: Bisect OP. Let M be the mid-point of OP.

Step 3: Draw a circle with centre at M and MO as radius.

Q and R are points of intersections of this circle with the circle having centre at O.

Step 4: Join PQ and PR.

PQ and PR are the required tangents.

33. $\text{LHS} = (\operatorname{cosec} A - \sin A)(\sec A - \cos A)$

$$= \left(\frac{-}{\sin A} - \sin A\right)\left(\frac{1}{\cos A} - \cos A\right)$$

$$= \left(\frac{1-\sin^2 A}{\sin A}\right)\left(\frac{1-\cos^2 A}{\cos A}\right)$$

$$= \frac{\cos^2 A}{\sin A} \times \frac{\sin^2 A}{\cos A}$$

$$= \frac{\sin A \cos A}{1}$$

$$=\frac{\sin A\cos A}{\sin^2 A+\cos^2 A}$$

$$=\frac{1}{\frac{\sin^2 A+\cos^2 A}{\sin A\cos A}}$$

$$=\frac{1}{\frac{\sin A}{\operatorname{Cos} A}+\frac{\cos A}{\sin A}}$$

$$=\frac{1}{\tan A+\cot A}$$

$=\text{RHS}$

34. For bigger circle, $OA=7\,\text{cm}$

Diameter of the smaller circle $=7\,\text{cm}$

Radius of the smaller circle $=\frac{7}{2}\text{cm}$

Area of the smaller circle $=\frac{22}{7}\times\frac{7}{2}\times\frac{7}{2}$

$=\frac{77}{2}\text{cm}^2$

Area of shaded region

$=$ Area of the smaller circle $+2\times$ Area of segment OCB

$$=\frac{77}{2}\text{cm}^2+2\times\left(\text{Area of quadrant}-\text{Area }\Delta ABC\right)$$

$$=\frac{77}{2}\text{cm}^2+2\times\left(\frac{1}{4}\times\frac{22}{7}\times7^2-\frac{1}{2}\times7\times7\right)\text{cm}^2$$

$$=\frac{77}{2}\text{cm}^2+49\left(\frac{11}{7}-1\right)\text{cm}^2$$

$$=\frac{77}{2}\text{cm}^2+49\left(\frac{4}{7}\right)\text{cm}^2$$

$= \frac{77}{2} \text{cm}^2 + 28 \text{cm}^2$

$= \frac{77+56}{2} \text{cm}^2$

$= \frac{133}{2} \text{cm}^2$

$= 66.5 \text{cm}^2$

OR

$ABCD$ is a square with side 7cm. Then,

Length of the diagonal of square $= 7\sqrt{2} \text{cm}$

Diameter of circle $=$ Diagonal of square

$\Rightarrow \quad BD = 7\sqrt{2} \text{cm}$

Radius of circle $= \frac{BD}{2}$

$= \frac{7\sqrt{2}}{2} \text{cm}$

Area of shaded region $=$ Area of circle $-$ Area of the square

$= \frac{22}{7} \times \frac{7\sqrt{2}}{2} \times \frac{7\sqrt{2}}{2} - 7 \times 7$

$= 77 - 49$

$= 28 \text{cm}^2$

Therefore, the area of the saded region is 28cm^2.

Section D

35. The given polynomial is $p(x)=3x^4-4x^3-10x^2+8x+8$

The two zeroes of $p(x)$ are $\sqrt{2}$ and $-\sqrt{2}$.

Therefore, $\left(x-\sqrt{2}\right)$ and $\left(x+\sqrt{2}\right)$ are factors of $p(x)$.

Also, $\left(x-\sqrt{2}\right)\left(x+\sqrt{2}\right)=x^2-2$

and so x^2-2 is a factor of $p(x)$.

Now,

$$
\begin{array}{r|l}
 & 3x^2-4x-4 \\
\hline
x^2-2 & 3x^4-4x^3-10x^2+8x+8 \\
 & 3x^4 \qquad\quad -6x^2 \\
 & - \qquad\qquad + \\
\hline
 & \quad -4x^3-4x^2+8x+8 \\
 & \quad -4x^3 \qquad\quad +8x \\
 & \quad + \qquad\qquad - \\
\hline
 & \qquad\quad -4x^2 \qquad +8 \\
 & \qquad\quad -4x^2 \qquad +8 \\
 & \qquad\quad + \qquad\quad - \\
\hline
 & \qquad\qquad\qquad 0
\end{array}
$$

$3x^4-4x^3-10x^2+8x8=\left(x^2-2\right)\left(3x^2-4x-4\right)$

$=\left(x^2-2\right)\left(3x^2-6x+2x-4\right)$

$=\left(x^2-2\right)(3x+2)(x-2)$

Equating $\left(x^2-2\right)(3x+2)(x-2)$ to zero, we get the zeroes of the given polynomial.

Hence, the zeroes of the given polynomial are:

$\sqrt{2},-\sqrt{2},-\frac{2}{3}$ and 2.

OR

The given polynomial is $g\left(x\right)=x^{3}-3x^{2}+x+2$

Here, divisor is $x^{2}-2x+1$.

Divide $g\left(x\right)=x^{3}-3x^{2}+x+2 by x^{2}-2x+1$ and find the remainder.

$$
\begin{array}{r|l}
 & \quad\quad\quad\quad\quad\quad x-1 \\
x^2-2x+1 & x^3-3x^2+x+2 \\
 & x^3-2x^2+x \\
 & -\quad +\quad - \\
\hline
 & \quad\quad -x^2 \quad\quad +2 \\
 & \quad\quad -x^2+2x-1 \\
 & \quad\quad +\quad -\quad + \\
\hline
 & \quad\quad\quad -2x+3
\end{array}
$$

So, Quotient $=x-1$ and Remainder $=-2x+3$.

The division algorithm states that

Dividend $=$ Divisor $\times$ Quotient $+$ Remainder

RHS $=$ Divisor $\times$ Quotient $+$ Remainder

$=\left(x^{2}-2x+1\right)\left(x-1\right)-2x+3$

$=x^{3}-2x^{2}+x-x^{2}+2x-1-2x+3$

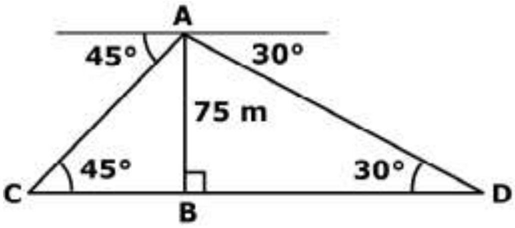
$=x^{3}-3x^{2}+x+2$

$=$ LHS

Thus, the division alogorithm is verified.

36. Let AB be a lighthouse and ships be at points C and D.

It is given that $AB = 75\text{m}$. We have to find the distance CD.



In ΔABC, we have

$$\tan 45° = \frac{AB}{BC}$$

or $1 = \frac{AB}{BC}$

or $BC = AB = 75 \quad ...(1)$

Now,

In ΔABD, we have

$$\tan 30° = \frac{AB}{BD}$$

or $\frac{1}{\sqrt{3}} = \frac{75}{BD}$

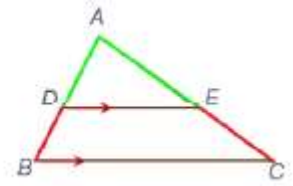
or $BD = 75\sqrt{3} \quad ...(2)$

From (1) and (2), we get

$$CD = BC + BD = 75 + 75\sqrt{3} = 75\left(1 + \sqrt{3}\right)$$

Therefore, the distance between the two ships is $75\left(1+\sqrt{3}\right)\text{m}$.

37.



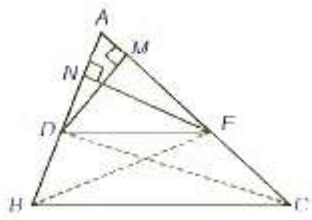
Given In $\Delta ABC = DE \| BC$.

To Prove: $\frac{AD}{DB} = \frac{AE}{EC}$.

Construction:

i. Join BE and CD.

ii Draw $DM \perp AC$ and $EN \perp AB$.



<u>Proof:</u>

$$\text{area}\left(\Delta ADE\right) = \frac{1}{2} \times \text{base} \times \text{height}$$

$$= \frac{1}{2} \times AD \times EN$$

and

$$\text{area}\left(\Delta BDE\right) = \frac{1}{2} \times BD \times EN$$

Therefore,

$$\frac{\text{area } \Delta ADE}{\text{area } \Delta BDE} = \frac{\frac{1}{2} \times AD \times EN}{\frac{1}{2} \times BD \times EN} = \frac{AD}{BD} \quad ...(1)$$

Similarly,

$$\frac{\text{area } \Delta ADE}{\text{area } \Delta DEC} = \frac{\frac{1}{2} \times AE \times DM}{\frac{1}{2} \times EC \times DM} = \frac{AE}{EC} \quad ...(2)$$

But $\text{area}(\Delta BDE) = \text{area}(\Delta DEC) \quad ...(3)$

Triangles on the same base and between the same parallels are equal in area.

Therefore, from (1), (2) and (3), we get

$$\frac{AD}{DB} = \frac{AE}{EC}$$

Hence, proved.

OR

ABC is an equilateral triangle.

Therefore, $AB = BC = AC$

Now,

$BD = DC = \frac{BC}{2} = \frac{AB}{2}$ (D is the midpoint of BC and $AB = BC$)

Using Pythagoras theorem in ΔADC, we get

$$AC^2 = AD^2 + DC^2$$

$$AB^2 = AD^2 + \left(\frac{AB}{2}\right)^2 \quad \left(AC = AB \text{ and } DC = \frac{AB}{2}\right)$$

$$AB^2 = AD^2 + \frac{AB^2}{4}$$

$$AB^2 - \frac{AB^2}{4} = AD^2$$

$$\frac{3AB^2}{4} = AD^2$$

$$3AB^2 = 4AD^2 \quad ...(1)$$

Similarly, using Pythagoras theorem in ΔAEB, we get

$3AB^2 = 4BE^2 \quad ....(2)$

Again, using Pythagoras theorem in ΔAFC, we get

$3AB^2 = 4CF^2 \quad ....(3)$

On adding equations (1), (2) and (3), we get

$3AB^2 + 3AB^2 + 3AB^2 = 4AD^2 + 4BE^2 + 4CF^2$

or, $9AB^2 = 4AD^2 + BE^2 + CF^2$

or, $4AD^2 + BE^2 + CF^2 = 9AB^2$

Hence, proved

38. Height of the frustum $= h = 14\,\text{cm}$

Radius of upper end of the frustum $= r_1 = 20\,\text{cm}$

Radius of lower end of the frustum $= r_2 = 8\,\text{cm}$

Capacity of container $=$ Volume of the frustum

$= \frac{1}{3}\pi h\left(r_1^2 + r_2^2 + r_1 r_2\right)$

$= \frac{14}{3} \times \frac{22}{7}\left(20^2 + 8^2 + 20 \times 8\right)$

$= \frac{44}{3}\left(400 + 64 + 160\right)$

$= \frac{44}{3} \times 624$

$= 9152\,\text{cm}^3$

39. Let A and B be the time taken by the smaller and the larger taps respectively to fill the tank.

Since both the taps together can fill the tank in $9\frac{3}{8}$ hours $=\frac{75}{8}$ hours.

So, $\frac{1}{A}+\frac{1}{B}=\frac{1}{\frac{75}{8}}$

Or, $\frac{1}{A}+\frac{1}{B}=\frac{8}{75} \quad ...1$

Tap with larger diameter takes 10 hours less than smaller one to fill the tank.

So, $A-10=B$

Or, $\frac{1}{B}=\frac{1}{A-10} \quad ...(2)$

By placing the value of $\frac{1}{B}$ from 2 in to 1, we get

$\frac{1}{A}+\frac{1}{A-10}=\frac{8}{75} \quad ...1$

Or, $\frac{A-10+A}{A^2-10A}=\frac{8}{75}$

Or, $\frac{A-5}{A^2-10A}=\frac{4}{75}$

Or, $75A-375=4A^2-40A$

Or, $4A^2-40A-75A+375=0$

Or, $4A^2-115A+375=0$

Or, $4A^2-100A-15A+375=0$

Or, $4A(A-25)-15(A-25)=0$

Or, $(A-25)(A-15)=0$

$A=25$ Hours ($A\neq\frac{15}{4}$ hours, because B becomes negative).

So, $B=25-10=15$ hours

OR

Let L be the length of the rectangle.

So, breadth of the rectangle $= L-3$

Area of the rectangle $= L L-3 \quad ...1$

Base of the isosceles triangle $= L-3$

Altitude of the isosceles triangle $= 12\,\text{m}$

Area of the isosceles triangle $= \frac{1}{2}(12)(-3) \quad ...(2)$

Given that

$L(-3) = \frac{1}{2}(2)(-3) - 4$

Or, $L^2 - 3L = 6L - 18 + 4$

Or, $L^2 - 9L + 14 = 0$

Or, $L^2 - 7L - 2L + 14 = 0$

Or, $L(-7) - 2(-7) = 0$

Or, $(-7)(-2) = 0$

So, $L = 7\,\text{m}$ $(\neq 2 \because L-3$ is negative).

Breadth $= 7\text{m} - 3\text{m} = 4\text{m}$

Length and breadth of the rectangle are $7\,\text{m}$ and $4\,\text{m}$ respectively.

40.

Marks	Cumulative frequency
Less than 10	7
Less than 20	$7+14=21$
Less than 30	$21+13=34$
Less than 40	$34+12=46$
Less than 50	$46+20=66$
Less than 60	$66+11=77$
Less than 70	$77+15=92$
Less than 80	$92+8=100$

Marks	Frequency (f)	Cumulative frequency (cf)
$0-10$	7	7
$10-20$	14	21
$20-30$	13	34
$30-40$	12	46
$40-50$	20	66
$50-60$	11	77
$60-70$	15	92
$70-80$	8	100

Now, plot $(10,7),(20,21),\ldots,(80,100)$ on the graph.