## Secondary School Examination

### March 2018

### Marking Scheme — Mathematics 30/1, 30/2, 30/3

**General Instructions:**

1. The Marking Scheme provides general guidelines to reduce subjectivity in the marking. The answers given in the Marking Scheme are suggested answers. The content is thus indicative. If a student has given any other answer which is different from the one given in the Marking Scheme, but conveys the meaning, such answers should be given full weightage

2. Evaluation is to be done as per instructions provided in the marking scheme. It should not be done according to one's own interpretation or any other consideration — Marking Scheme should be strictly adhered to and religiously followed.

3. Alternative methods are accepted. Proportional marks are to be awarded.

4. If a candidate has attempted an extra question, marks obtained in the question attempted first should be retained and the other answer should be scored out.

5. A full scale of marks - 0 to 80 has to be used. Please do not hesitate to award full marks if the answer deserves it.

6. Separate Marking Scheme for all the three sets has been given.

7. As per orders of the Hon'ble Supreme Court, the candidates would now be permitted to obtain photocopy of the Answer book on request on payment of the prescribed fee. All examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

QUESTION PAPER CODE 30/1

EXPECTED ANSWER/VALUE POINTS

SECTION A

1. $x = 3$ is one root of the equation

∴ $9 - 6k - 6 = 0$ ½

⇒ $k = \dfrac{1}{2}$ ½

2. The required numbers are 2 and 4. ½

HCF of 2 and 4 is 2. ½

3. $OP = \sqrt{x^2 + y^2}$ 1

4. $a + 6(-4) = 4$ ½

⇒ $a = 28$ ½

5. ∵ $\cos 67° = \sin 23°$

∴ $\cos^2 67° - \sin^2 23 = 0$ 1

6. $\dfrac{\text{ar } \Delta ABC}{\text{ar } \Delta PQR} = \dfrac{AB^2}{PQ^2}$

$= \left(\dfrac{1}{3}\right)^2 = \dfrac{1}{9}$ 1

SECTION B

7. Let us assume $5 + 3\sqrt{2}$ is a rational number.

∴ $5 + 3\sqrt{2} = \dfrac{p}{q}$ where $q \neq 0$ and p and q are integers. ½

⇒ $\sqrt{2} = \dfrac{p - 5q}{3q}$ ½

⇒ $\sqrt{2}$ is a rational number as RHS is rational ½

This contradicts the given fact that $\sqrt{2}$ is irrational.

Hence $5 + 3\sqrt{2}$ is an irrational number. ½

(2) 30/1

8.  AB = DC and BC = AD

$$\Rightarrow \quad x + y = 30$$
$$\text{and} \quad x - y = 14$$

> 1

Solving to get x = 22 and y = 8.

> ½ + ½

9.  S = 3 + 6 + 9 + 12 + ... + 24

= 3(1 + 2 + 3 + ... + 8)

> ½

$$= 3 \times \frac{8 \times 9}{2}$$

> 1

= 108

> ½

10.  Let  AP : PB = k : 1

$$\therefore \quad \frac{6k + 2}{k + 1} = 4$$



> 1

$$\Rightarrow \quad k = 1, \text{ ratio is } 1 : 1$$

> ½

Hence m = $\dfrac{-3 + 3}{2}$ = 0

> ½

11.  Total number of possible outcomes = 36

(i)  Doublets are (1, 1) (2, 2) (3, 3) (4, 4) (5, 5) (6, 6)

Total number of doublets = 6

> ½

$$\therefore \quad \text{Prob (getting a doublet)} = \frac{6}{36} \text{ or } \frac{1}{6}$$

> ½

(ii)  Favourable outcomes are (4, 6) (5, 5) (6, 4) i.e., 3

> ½

$$\therefore \quad \text{Prob (getting a sum 10)} = \frac{3}{36} \text{ or } \frac{1}{12}$$

> ½

12.  Total number of outcomes = 98

(i)  Favourable outcomes are 8, 16, 24, ..., 96 i.e., 12

> ½

$$\therefore \quad \text{Prob (integer is divisible by 8)} = \frac{12}{98} \text{ or } \frac{6}{49}$$

> 1

(ii)   Prob (integer is not divisible by 8) $= 1 - \dfrac{6}{49}$

$= \dfrac{43}{49}$                                                          ½

## SECTION C

13.   $404 = 2 \times 2 \times 101 = 2^2 \times 101$

$96 = 2 \times 2 \times 2 \times 2 \times 2 \times 3 = 2^5 \times 3$

∴   HCF of 404 and 96 $= 2^2 = 4$                                1

LCM of 404 and 96 $= 101 \times 2^5 \times 3 = 9696$           1

HCF $\times$ LCM $= 4 \times 9696 = 38784$

Also  $404 \times 96 = 38784$

Hence HCF $\times$ LCM = Product of 404 and 96.          1

14.   $p(x) = 2x^4 - 9x^3 + 5x^2 + 3x - 1$

$2 + \sqrt{3}$ and $2 - \sqrt{3}$ are zeroes of $p(x)$

∴   $p(x) = (x - 2 - \sqrt{3})(x - 2 + \sqrt{3}) \times g(x)$

$= (x^2 - 4x + 1)\, g(x)$                                    1

$(2x^4 - 9x^3 + 5x^2 + 3x - 1) \div (x^2 - 4x + 1) = 2x^2 - x - 1$   1

∴   $g(x) = 2x^2 - x - 1$

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

Therefore other zeroes are $x = -\dfrac{1}{2}$ and $x = 1$

∴   Therefore all zeroes are $2 + \sqrt{3},\ 2 - \sqrt{3},\ -\dfrac{1}{2}$ and 1          1

**15.**



ABCD is a parallelogram

∴ diagonals AC and BD bisect each other

Therefore

Mid point of BD is same as mid point of AC ½

$$\Rightarrow \left(\frac{a+1}{2}, \frac{2}{2}\right) = \left(\frac{-2+4}{2}, \frac{b+1}{2}\right)$$ 1

$$\Rightarrow \frac{a+1}{2} = 1 \text{ and } \frac{b+1}{2} = 1$$

$\Rightarrow$ a = 1, b = 1. Therefore length of sides are $\sqrt{10}$ units each. ½+1

OR



Area of quad ABCD = Ar ΔABD + Ar ΔBCD ½

Area of ΔABD = $\frac{1}{2}|(-5)(-5-5) + (-4)(5-7) + (4)(7+5)|$

= 53 sq units 1

Area of ΔBCD = $\frac{1}{2}|(-4)(-6-5) + (-1)(5+5) + 4(-5+6)|$

= 19 sq units 1

Hence area of quad. ABCD = 53 + 19 = 72 sq units ½

**16.** Let the usual speed of the plane be x km/hr.

$$\therefore \quad \frac{1500}{x} - \frac{1500}{x+100} = \frac{30}{60}$$ 1

$\Rightarrow$ x² + 100x – 300000 = 0

$\Rightarrow$ x² + 600x – 500x – 300000 = 0
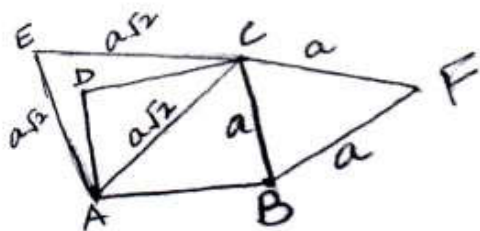
$\Rightarrow$ (x + 600)(x – 500) = 0 1

x ≠ –600, ∴ x = 500 ½

Speed of plane = 500 km/hr ½

**17.**



Let the side of the square be 'a' units

$\therefore$ $AC^2 = a^2 + a^2 = 2a^2$

$\Rightarrow$ $AC = \sqrt{2}$ a units                                      1

Area of equilateral $\triangle BCF = \dfrac{\sqrt{3}}{4}a^2$ sq.u          ½

Area of equilateral $\triangle ACE = \dfrac{\sqrt{3}}{4}(\sqrt{2}\,a)^2 = \dfrac{\sqrt{3}}{2}a^2$ sq.u          1

$\Rightarrow$ Area $\triangle BCF = \dfrac{1}{2}$ Ar $\triangle ACE$          ½

**OR**

Let $\triangle ABC \sim \triangle PQR$.

$\therefore$ $\dfrac{ar\ \triangle ABC}{ar\ \triangle PQR} = \dfrac{AB^2}{PQ^2} = \dfrac{BC^2}{QR^2} = \dfrac{AC^2}{PR^2}$          1

Given ar $\triangle ABC$ = ar $\triangle PQR$

$\Rightarrow$ $\dfrac{AB^2}{PQ^2} = 1 = \dfrac{BC^2}{QR^2} = \dfrac{AC^2}{PR^2}$          1

$\Rightarrow$ $AB = PQ,\ BC = QR,\ AC = PR$

$\Rightarrow$ Therefore $\triangle ABC \cong \triangle PQR$. (sss congruence rule)          1

**18.** Correct given, To prove, Figure, Construction          ½ ×4=2

Correct proof          1

**19.** $4 \tan \theta = 3$

$\Rightarrow$ $\tan \theta = \dfrac{3}{4}$

$\Rightarrow$ $\sin \theta = \dfrac{3}{5}$ and $\cos \theta = \dfrac{4}{5}$          ½ + ½

$\therefore$ $\dfrac{4 \sin \theta - \cos \theta + 1}{4 \sin \theta + \cos \theta - 1} = \dfrac{4 \times \dfrac{3}{5} - \dfrac{4}{5} + 1}{4 \times \dfrac{3}{5} + \dfrac{4}{5} - 1}$          1

$= \dfrac{13}{11}$          1

OR

tan 2A = cot (A – 18°)

$\Rightarrow$ 90° – 2A = A – 18°                                1

$\Rightarrow$ 3A = 108°                                          1

$\Rightarrow$ A = 36°                                            1

20. Radius of each arc drawn = 6 cm                              ½

Area of one quadrant = $(3.14) \times \dfrac{36}{4}$

Area of four quadrants = 3.14 × 36 = 113.04 cm²                  1

Area of square ABCD = 12 × 12 = 144 cm²                          1

Hence Area of shaded region = 144 – 113.04

= 30.96 cm²                                                      ½

21. Total surface Area of article = CSA of cylinder + CSA of 2 hemispheres

CSA of cylinder = 2πrh

$= 2 \times \dfrac{22}{7} \times 3.5 \times 10$

= 220 cm²                                                        1

Surface Area of two hemispherical scoops = $4 \times \dfrac{22}{7} \times 3.5 \times 3.5$

= 154 cm²                                                        1

Total surface Area of article = 220 + 154

= 374 cm²                                                        1

OR

Radius of conical heap = 12 m                                    ½

Volume of rice = $\dfrac{1}{3} \times \dfrac{22}{7} \times 12 \times 12 \times 3.5$ m³

= 528 m³                                                         1

Area of canvas cloth required = πrl

$$l = \sqrt{12^2 + (3.5)^2} = 12.5 \text{ m}$$

½

$$\therefore \quad \text{Area of canvas required} = \frac{22}{7} \times 12 \times 12.5$$

$$= 471.4 \text{ m}^2$$

1

**22.**

| Salary (in thousand Rs) | No. of persons (f) | cf |
|---|---|---|
| 5–10 | 49 | 49 |
| 10–15 | 133 | 182 |
| 15–20 | 63 | 245 |
| 20–25 | 15 | 260 |
| 25–30 | 6 | 266 |
| 30–35 | 7 | 273 |
| 35–40 | 4 | 277 |
| 40–45 | 2 | 279 |
| 45–50 | 1 | 280 |

1

$$\frac{N}{2} = \frac{280}{2} = 140$$

Median class is 10–15

$$\text{Median} = l + \frac{h}{f}\left(\frac{N}{2} - C\right)$$

$$= 10 + \frac{5}{133}(140 - 49)$$

1

$$= 10 + \frac{5 \times 91}{133}$$

$$= 13.42$$

Median salary is Rs 13.42 thousand or Rs 13420 (approx)

1

## SECTION D

23. Let the speed of stream be x km/hr.

    ∴ The speed of the boat upstream = (18 − x) km/hr
    and Speed of the boat downstream = (18 + x) km/hr          1

    As given in the question,

    $$\frac{24}{18-x} - \frac{24}{18+x} = 1$$          1

    ⇒  $x^2 + 48x - 324 = 0$          ½

    ⇒  $(x + 54)(x − 6) = 0$

    $x \neq -54$,  ∴ x = 6          1

    ∴ Speed of the stream = 6 km/hr.          ½

    ### OR

    Let the original average speed of train be x km/hr.

    Therefore  $\frac{63}{x} + \frac{72}{x+6} = 3$          1 ½

    ⇒  $x^2 - 39x - 126 = 0$          1

    ⇒  $(x − 42)(x + 3) = 0$

    $x \neq -3$   ∴ x = 42          1

    Original speed of train is 42 km/hr.          ½

24. Let the four consecutive terms of the A.P. be

    a − 3d, a − d, a + d, a + 3d.          ½

    By given conditions

      $(a − 3d) + (a − d) + (a + d) + (a + 3d) = 32$

    ⇒  4a = 32

    ⇒  a = 8          1

    and  $\frac{(a-3d)(a+3d)}{(a-d)(a+d)} = \frac{7}{15}$          1

    ⇒  $8a^2 = 128d^2$

$$\Rightarrow \quad d^2 = 4$$

½

$$\Rightarrow \quad d = \pm 2$$

1

∴ Numbers are 2, 6, 10, 14 or 14, 10, 6, 2.

**25.**

Draw AE ⊥ BC



ΔAEB ≅ ΔAEC    (RHS congruence rule)

$$\therefore \quad BE = EC = \frac{1}{2}BC = \frac{1}{2}AB$$

1

Let AB = BC = AC = x

Now $BE = \dfrac{x}{2}$ and DE = BE − BD

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

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

1

$$\text{Now} \quad AB^2 = AE^2 + BE^2 \qquad \qquad ...(1)$$
$$\text{and} \quad AD^2 = AE^2 + DE^2 \qquad \qquad ...(2)$$

1

From (1) and (2)  $AB^2 - AD^2 = BE^2 - DE^2$

$$\Rightarrow \quad x^2 - AD^2 = \left(\frac{x}{2}\right)^2 - \left(\frac{x}{6}\right)^2$$

$$\Rightarrow \quad AD^2 = x^2 - \frac{x^2}{4} + \frac{x^2}{36}$$

$$\Rightarrow \quad AD^2 = \frac{28}{36}x^2$$

1

$$\Rightarrow \quad 9AD^2 = 7AB^2$$

**OR**

Given, to Prove, Construction and Figure

½ ×4=2

Correct Proof

2

**26.**  Correct Construction of ΔABC

2

Correct construction of similar to ΔABC.

2

27.  LHS $= \dfrac{\sin A - 2\sin^3 A}{2\cos^3 A - \cos A}$

$= \dfrac{\sin A(1 - 2\sin^2 A)}{\cos A(2\cos^2 A - 1)}$      1

$= \dfrac{\sin A(1 - 2(1 - \cos^2 A))}{\cos A(2\cos^2 A - 1)}$      1

$= \tan A \dfrac{(2\cos^2 A - 1)}{(2\cos^2 A - 1)}$      1

$= \tan A = $ RHS      1

28.  Here $r_1 = 15$ cm, $r_2 = 5$ cm and $h = 24$ cm

(i) Area of metal sheet = CSA of the bucket + area of lower end

$= \pi l(r_1 + r_2) + \pi r_2^2$      1
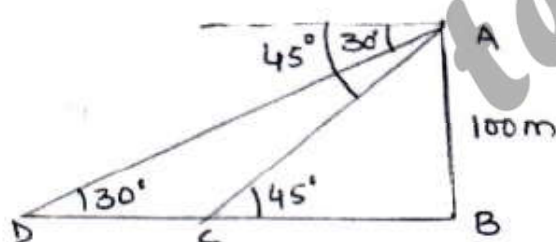
where $l = \sqrt{24^2 + (15 - 5)^2} = 26$ cm      1

$\therefore$ Surface area of metal sheet $= 3.14(26 \times 20 + 25)$ cm$^2$

$= 1711.3$ cm$^2$      1

We should avoid use of plastic because it is non-degradable or similar value.      1

29.  Figure      1



Let AB be the tower and ships are at points C and D.

$\tan 45° = \dfrac{AB}{BC}$

$\Rightarrow \dfrac{AB}{BC} = 1$

$\Rightarrow AB = BC$      1

Also $\tan 30° = \dfrac{1}{\sqrt{3}} = \dfrac{AB}{BC + CD}$

$\Rightarrow \dfrac{1}{\sqrt{3}} = \dfrac{AB}{AB + CD}$      1

$\Rightarrow AB + CD = \sqrt{3}AB$

$\Rightarrow CD = AB(\sqrt{3} - 1)$

$= 100 \times (1.732 - 1)$      1

$= 73.2$ m.

(11) 30/1

**30.**

| Class | x | f | fx |
|---|---|---|---|
| 11–13 | 12 | 3 | 36 |
| 13–15 | 14 | 6 | 84 |
| 15–17 | 16 | 9 | 144 |
| 17–19 | 18 | 13 | 234 |
| 19–21 | 20 | f | 20f |
| 21–23 | 22 | 5 | 110 |
| 23–25 | 24 | 4 | 96 |
| | | 40 + f | 704 + 20f |

For x    ½

Σf    ½

Σfx    1

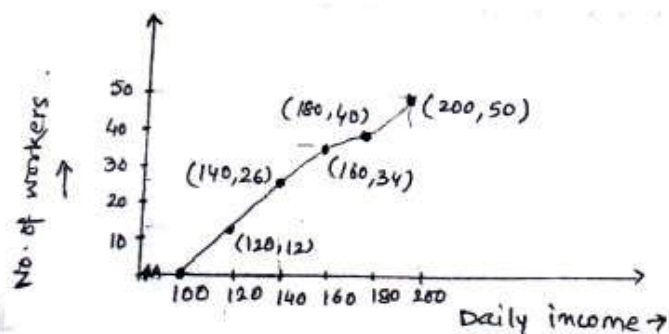$$\text{Mean} = 18 = \frac{704 + 20f}{40 + f}$$

1

$$\Rightarrow \quad 720 + 18f = 704 + 20f$$

$$\Rightarrow \quad f = 8$$

1

OR

Cumulative frequency distribution table of less than type is

| Daily income | Cumulative frequency |
|---|---|
| Less than 100 | 0 |
| Less than 120 | 12 |
| Less than 140 | 26 |
| Less than 160 | 34 |
| Less than 180 | 40 |
| Less than 200 | 50 |

1½



2½

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### March 2018

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# QUESTION PAPER CODE 30/2
## EXPECTED ANSWER/VALUE POINTS

### SECTION A

1. $\dfrac{ar\ \Delta ABC}{ar\ \Delta PQR} = \dfrac{AB^2}{PQ^2}$

$= \left(\dfrac{1}{3}\right)^2 = \dfrac{1}{9}$     1

2. $\because$    $\cos 67° = \sin 23°$

$\therefore$    $\cos^2 67° - \sin^2 23 = 0$     1

3. $OP = \sqrt{x^2 + y^2}$     1

4. $x = 3$ is one root of the equation

$\therefore$    $9 - 6k - 6 = 0$     ½

$\Rightarrow$    $k = \dfrac{1}{2}$     ½

5. The required numbers are 2 and 4.     ½

HCF of 2 and 4 is 2.     ½

6. $a + 6(-4) = 4$     ½

$\Rightarrow$    $a = 28$     ½

### SECTION B

7. Total number of outcomes = 98

(i) Favourable outcomes are 8, 16, 24, ..., 96 i.e., 12     ½

$\therefore$ Prob (integer is divisible by 8) $= \dfrac{12}{98}$ or $\dfrac{6}{49}$     1

(ii) Prob (integer is not divisible by 8) $= 1 - \dfrac{6}{49}$

$= \dfrac{43}{49}$     ½

**8.** Total number of possible outcomes = 36

    (i)    Doublets are (1, 1) (2, 2) (3, 3) (4, 4) (5, 5) (6, 6)

        Total number of doublets = 6            ½

    ∴    Prob (getting a doublet) = $\dfrac{6}{36}$ or $\dfrac{1}{6}$            ½

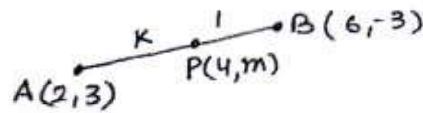    (ii)    Favourable outcomes are (4, 6) (5, 5) (6, 4) i.e., 3            ½

    ∴    Prob (getting a sum 10) = $\dfrac{3}{36}$ or $\dfrac{1}{12}$            ½

**9.** Let    AP : PB = k : 1

    ∴    $\dfrac{6k + 2}{k + 1} = 4$            1



    ⇒    k = 1, ratio is 1 : 1            ½

    Hence m = $\dfrac{-3 + 3}{2} = 0$            ½

**10.** Let us assume $5 + 3\sqrt{2}$ is a rational number.

    ∴    $5 + 3\sqrt{2} = \dfrac{p}{q}$ where q ≠ 0 and p and q are integers.            ½

    ⇒    $\sqrt{2} = \dfrac{p - 5q}{3q}$            ½

    ⇒    $\sqrt{2}$ is a rational number as RHS is rational            ½

    This contradicts the given fact that $\sqrt{2}$ is irrational.

    Hence $5 + 3\sqrt{2}$ is an irrational number.            ½

**11.** AB = DC and BC = AD

    ⇒    x + y = 30
    and    x − y = 14            1

    Solving to get  x = 22 and y = 8.            ½ + ½

**12.** S = 3 + 6 + 9 + 12 + ... + 24

= 3(1 + 2 + 3 + ... + 8)                                          ½

$= 3 \times \dfrac{8 \times 9}{2}$                                          1

= 108                                                              ½

## SECTION C

**13.** Let the usual speed of the plane be x km/hr.

∴      $\dfrac{1500}{x} - \dfrac{1500}{x+100} = \dfrac{30}{60}$          1

⇒      $x^2 + 100x - 300000 = 0$

⇒      $x^2 + 600x - 500x - 300000 = 0$

⇒      $(x + 600)(x - 500) = 0$                                          1

x ≠ –600,     ∴ x = 500                                          ½

Speed of plane = 500 km/hr                                          ½

**14.**



Let the side of the square be 'a' units

∴   $AC^2 = a^2 + a^2 = 2a^2$

⇒   $AC = \sqrt{2}\,a$ units                                          1

Area of equilateral ΔBCF $= \dfrac{\sqrt{3}}{4} a^2$ sq.u          ½

Area of equilateral ΔACE $= \dfrac{\sqrt{3}}{4}(\sqrt{2}\,a)^2 = \dfrac{\sqrt{3}}{2} a^2$ sq.u          1

⇒   Area ΔBCF $= \dfrac{1}{2}$ Ar ΔACE                                          ½

OR

Let   ΔABC ~ ΔPQR.

∴   $\dfrac{ar\,\Delta ABC}{ar\,\Delta PQR} = \dfrac{AB^2}{PQ^2} = \dfrac{BC^2}{QR^2} = \dfrac{AC^2}{PR^2}$          1

Given ar ΔABC = ar ΔPQR

$$\Rightarrow \quad \frac{AB^2}{PQ^2} = 1 = \frac{BC^2}{QR^2} = \frac{AC^2}{PR^2}$$  1

$$\Rightarrow \quad AB = PQ, \ BC = QR, \ AC = PR$$

$$\Rightarrow \quad \text{Therefore } \triangle ABC \cong \triangle PQR. \ (\text{sss congruence rule})$$  1

15. Correct given, To prove, Figure, Construction  ½ ×4=2

Correct proof  1

16. Total surface Area of article = CSA of cylinder + CSA of 2 hemispheres

CSA of cylinder = $2\pi rh$

$$= 2 \times \frac{22}{7} \times 3.5 \times 10$$

$$= 220 \ cm^2$$  1

Surface Area of two hemispherical scoops $= 4 \times \frac{22}{7} \times 3.5 \times 3.5$

$$= 154 \ cm^2$$  1

Total surface Area of article  = 220 + 154

$$= 374 \ cm^2$$  1

**OR**

Radius of conical heap = 12 m  ½

Volume of rice $= \frac{1}{3} \times \frac{22}{7} \times 12 \times 12 \times 3.5 \ m^3$

$$= 528 \ m^3$$  1

Area of canvas cloth required = $\pi rl$

$$l = \sqrt{12^2 + (3.5)^2} = 12.5 \ m$$  ½

$$\therefore \quad \text{Area of canvas required} = \frac{22}{7} \times 12 \times 12.5$$

$$= 471.4 \ m^2$$  1

**17.**

| Salary (in thousand Rs) | No. of persons (f) | cf |
|---|---|---|
| 5–10 | 49 | 49 |
| 10–15 | 133 | 182 |
| 15–20 | 63 | 245 |
| 20–25 | 15 | 260 |
| 25–30 | 6 | 266 |
| 30–35 | 7 | 273 |
| 35–40 | 4 | 277 |
| 40–45 | 2 | 279 |
| 45–50 | 1 | 280 |

1

$$\frac{N}{2} = \frac{280}{2} = 140$$

Median class is 10–15

$$\text{Median} = l + \frac{h}{f}\left(\frac{N}{2} - C\right)$$

1

$$= 10 + \frac{5}{133}(140 - 49)$$

$$= 10 + \frac{5 \times 91}{133}$$

$$= 13.42$$

Median salary is Rs 13.42 thousand or Rs 13420 (approx)

1

**18.** $4 \tan\theta = 3$

$$\Rightarrow \quad \tan\theta = \frac{3}{4}$$

$$\Rightarrow \quad \sin\theta = \frac{3}{5} \text{ and } \cos\theta = \frac{4}{5}$$

½ + ½

$$\therefore \quad \frac{4\sin\theta - \cos\theta + 1}{4\sin\theta + \cos\theta - 1} = \frac{4 \times \frac{3}{5} - \frac{4}{5} + 1}{4 \times \frac{3}{5} + \frac{4}{5} - 1}$$

1

$$= \frac{13}{11}$$

1

OR

$\tan 2A = \cot (A - 18°)$

$\Rightarrow \quad 90° - 2A = A - 18°$     1

$\Rightarrow \quad 3A = 108°$     1

$\Rightarrow \quad A = 36°$     1

**19.** Radius of each arc drawn = 6 cm     ½
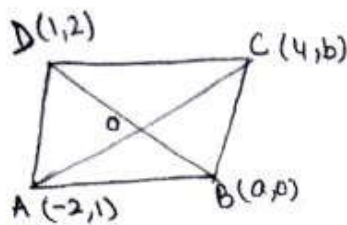
Area of one quadrant = $(3.14) \times \dfrac{36}{4}$

Area of four quadrants = $3.14 \times 36 = 113.04 \text{ cm}^2$     1

Area of square ABCD = $12 \times 12 = 144 \text{ cm}^2$     1

Hence Area of shaded region = $144 - 113.04$

$= 30.96 \text{ cm}^2$     ½

**20.**



ABCD is a parallelogram

∴ diagonals AC and BD bisect each other

Therefore

Mid point of BD is same as mid point of AC     ½

$\Rightarrow \left( \dfrac{a+1}{2}, \dfrac{2}{2} \right) = \left( \dfrac{-2+4}{2}, \dfrac{b+1}{2} \right)$     1

$\Rightarrow \dfrac{a+1}{2} = 1$ and $\dfrac{b+1}{2} = 1$

$\Rightarrow a = 1, b = 1$. Therefore length of sides are $\sqrt{10}$ units each.     ½ +1

OR

Area of quad ABCD = Ar ΔABD + Ar ΔBCD     ½

Area of ΔABD = $\dfrac{1}{2} \left| (-5)(-5-5) + (-4)(5-7) + (4)(7+5) \right|$

$= 53$ sq units     1

Area of ΔBCD = $\dfrac{1}{2} \left| (-4)(-6-5) + (-1)(5+5) + 4(-5+6) \right|$

$= 19$ sq units     1

Hence area of quad. ABCD = $53 + 19 = 72$ sq units     ½

21.   $404 = 2 \times 2 \times 101 = 2^2 \times 101$

    $96 = 2 \times 2 \times 2 \times 2 \times 2 \times 3 = 2^5 \times 3$

    $\therefore$   HCF of 404 and 96 $= 2^2 = 4$      1

        LCM of 404 and 96 $= 101 \times 2^5 \times 3 = 9696$    1

        HCF $\times$ LCM $= 4 \times 9696 = 38784$

        Also  $404 \times 96 = 38784$

        Hence HCF $\times$ LCM = Product of 404 and 96.      1

22.   $p(x) = 2x^4 - 9x^3 + 5x^2 + 3x - 1$

    $2 + \sqrt{3}$ and $2 - \sqrt{3}$ are zeroes of $p(x)$

    $\therefore$   $p(x) = (x - 2 - \sqrt{3})(x - 2 + \sqrt{3}) \times g(x)$

          $= (x^2 - 4x + 1) g(x)$      1

    $(2x^4 - 9x^3 + 5x^2 + 3x - 1) \div (x^2 - 4x + 1) = 2x^2 - x - 1$    1

    $\therefore$   $g(x) = 2x^2 - x - 1$

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

    Therefore other zeroes are $x = -\dfrac{1}{2}$ and $x = 1$

    $\therefore$   Therefore all zeroes are $2 + \sqrt{3}, 2 - \sqrt{3}, -\dfrac{1}{2}$ and $1$      1

## SECTION D

23.   Correct Construction of $\triangle ABC$      2

    Correct construction of similar to $\triangle ABC$.      2

24.   Let the four consecutive terms of the A.P. be

    $a - 3d, a - d, a + d, a + 3d$.      ½

    By given conditions

        $(a - 3d) + (a - d) + (a + d) + (a + 3d) = 32$

    $\Rightarrow$   $4a = 32$

    $\Rightarrow$   $a = 8$      1

    and  $\dfrac{(a - 3d)(a + 3d)}{(a - d)(a + d)} = \dfrac{7}{15}$      1
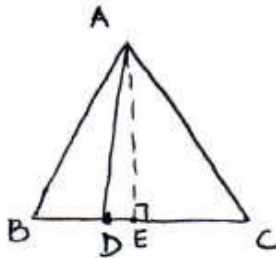
$$\Rightarrow \quad 8a^2 = 128d^2$$

$$\Rightarrow \quad d^2 = 4$$ ½

$$\Rightarrow \quad d = \pm 2$$ 1

∴ Numbers are 2, 6, 10, 14 or 14, 10, 6, 2.

**25.**

Draw $AE \perp BC$

$\triangle AEB \cong \triangle AEC$     (RHS congruence rule)

$$\therefore \quad BE = EC = \frac{1}{2}BC = \frac{1}{2}AB$$ 1

Let $AB = BC = AC = x$

Now $BE = \dfrac{x}{2}$ and $DE = BE - BD$

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

$$= \frac{x}{6}$$ 1

Now   $AB^2 = AE^2 + BE^2$     ...(1)

and   $AD^2 = AE^2 + DE^2$     ...(2) 1

From (1) and (2)   $AB^2 - AD^2 = BE^2 - DE^2$

$$\Rightarrow \quad x^2 - AD^2 = \left(\frac{x}{2}\right)^2 - \left(\frac{x}{6}\right)^2$$

$$\Rightarrow \quad AD^2 = x^2 - \frac{x^2}{4} + \frac{x^2}{36}$$

$$\Rightarrow \quad AD^2 = \frac{28}{36}x^2$$ 1

$$\Rightarrow \quad 9AD^2 = 7AB^2$$

OR

Given, to Prove, Construction and Figure      $\frac{1}{2} \times 4 = 2$

Correct Proof      2

26.  Let the speed of stream be x km/hr.

$\therefore$     The speed of the boat upstream = (18 – x) km/hr
and   Speed of the boat downstream = (18 + x) km/hr      1

As given in the question,

$$\frac{24}{18-x} - \frac{24}{18+x} = 1$$      1

$\Rightarrow$    $x^2 + 48x - 324 = 0$      $\frac{1}{2}$

$\Rightarrow$    $(x + 54)(x – 6) = 0$

      $x \neq -54,$   $\therefore$ x = 6      1

$\therefore$    Speed of the stream = 6 km/hr.      $\frac{1}{2}$

OR

Let the original average speed of train be x km/hr.

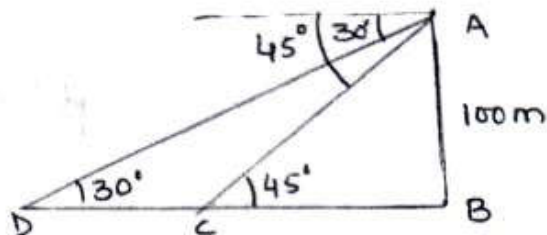Therefore   $\frac{63}{x} + \frac{72}{x+6} = 3$      $1\frac{1}{2}$

$\Rightarrow$    $x^2 - 39x - 126 = 0$      1

$\Rightarrow$    $(x – 42)(x + 3) = 0$

      $x \neq -3$   $\therefore$ x = 42      1

Original speed of train is 42 km/hr.      $\frac{1}{2}$

**27.**



Figure       1

Let AB be the tower and ships are at points C and D.

$$\tan 45° = \frac{AB}{BC}$$

$$\Rightarrow \quad \frac{AB}{BC} = 1$$

$$\Rightarrow \quad AB = BC \hspace{4cm} 1$$

Also $\tan 30° = \dfrac{1}{\sqrt{3}} = \dfrac{AB}{BC + CD}$

$$\Rightarrow \quad \frac{1}{\sqrt{3}} = \frac{AB}{AB + CD} \hspace{3cm} 1$$

$$\Rightarrow \quad AB + CD = \sqrt{3}AB$$

$$\Rightarrow \quad CD = AB(\sqrt{3} - 1)$$

$$= 100 \times (1.732 - 1) \hspace{2cm} 1$$

$$= 73.2 \text{ m.}$$

**28.** Here $r_1 = 15$ cm, $r_2 = 5$ cm and $h = 24$ cm

  (i)   Area of metal sheet = CSA of the bucket + area of lower end

$$= \pi l(r_1 + r_2) + \pi r_2^2 \hspace{3cm} 1$$

where $l = \sqrt{24^2 + (15 - 5)^2} = 26$ cm        1

∴ Surface area of metal sheet $= 3.14(26 \times 20 + 25)$ cm²

$$= 1711.3 \text{ cm}^2 \hspace{3cm} 1$$

We should avoid use of plastic because it is non-degradable or similar value.     1

**29.**

| Class | x | f | fx | | |
|---|---|---|---|---|---|
| 11–13 | 12 | 3 | 36 | | |
| 13–15 | 14 | 6 | 84 | | |
| 15–17 | 16 | 9 | 144 | | |
| 17–19 | 18 | 13 | 234 | | |
| 19–21 | 20 | f | 20f | | |
| 21–23 | 22 | 5 | 110 | For x | ½ |
| 23–25 | 24 | 4 | 96 | Σf | ½ |
| | | $\overline{40 + f}$ | $\overline{704 + 20f}$ | Σfx | 1 |

(22)   30/2

$$\text{Mean} = 18 = \frac{704 + 20f}{40 + f} \qquad 1$$

$$\Rightarrow \quad 720 + 18f = 704 + 20f$$

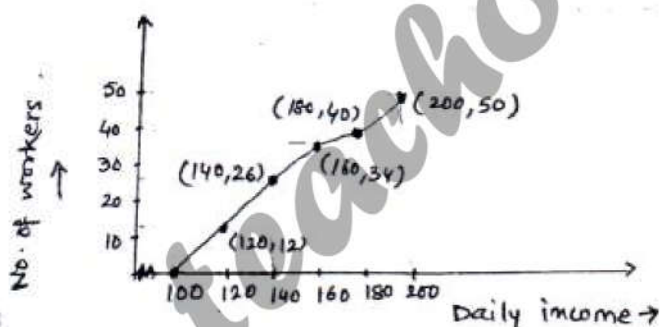$$\Rightarrow \quad f = 8 \qquad 1$$

OR

Cumulative frequency distribution table of less than type is

| Daily income | Cumulative frequency |
|---|---|
| Less than 100 | 0 |
| Less than 120 | 12 |
| Less than 140 | 26 |
| Less than 160 | 34 |
| Less than 180 | 40 |
| Less than 200 | 50 |

$1\frac{1}{2}$



$2\frac{1}{2}$

**30.** $\quad \text{LHS} = \dfrac{\sin A - 2\sin^3 A}{2\cos^3 A - \cos A}$

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

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

$$= \tan A \frac{(2\cos^2 A - 1)}{(2\cos^2 A - 1)} \qquad 1$$

$$= \tan A = \text{RHS} \qquad 1$$

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## Secondary School Examination

## March 2018

### Marking Scheme — Mathematics 30/1, 30/2, 30/3

**General Instructions:**

1. The Marking Scheme provides general guidelines to reduce subjectivity in the marking. The answers given in the Marking Scheme are suggested answers. The content is thus indicative. If a student has given any other answer which is different from the one given in the Marking Scheme, but conveys the meaning, such answers should be given full weightage

2. Evaluation is to be done as per instructions provided in the marking scheme. It should not be done according to one's own interpretation or any other consideration — Marking Scheme should be strictly adhered to and religiously followed.

3. Alternative methods are accepted. Proportional marks are to be awarded.

4. If a candidate has attempted an extra question, marks obtained in the question attempted first should be retained and the other answer should be scored out.

5. A full scale of marks - 0 to 80 has to be used. Please do not hesitate to award full marks if the answer deserves it.

6. Separate Marking Scheme for all the three sets has been given.

7. As per orders of the Hon'ble Supreme Court, the candidates would now be permitted to obtain photocopy of the Answer book on request on payment of the prescribed fee. All examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

QUESTION PAPER CODE 30/3

EXPECTED ANSWER/VALUE POINTS

SECTION A

1.  $\because$  $\cos 67° = \sin 23°$

    $\therefore$  $\cos^2 67° - \sin^2 23 = 0$                                                   1

2.  $a + 6(-4) = 4$                                                                          $\frac{1}{2}$

    $\Rightarrow$  $a = 28$                                                                    $\frac{1}{2}$

3.  $\dfrac{ar\ \Delta ABC}{ar\ \Delta PQR} = \dfrac{AB^2}{PQ^2}$

    $= \left(\dfrac{1}{3}\right)^2 = \dfrac{1}{9}$                                              1

4.  The required numbers are 2 and 4.                                                        $\frac{1}{2}$

    HCF of 2 and 4 is 2.                                                                     $\frac{1}{2}$

5.  $OP = \sqrt{x^2 + y^2}$                                                                  1

6.  $x = 3$ is one root of the equation

    $\therefore$  $9 - 6k - 6 = 0$                                                             $\frac{1}{2}$

    $\Rightarrow$  $k = \dfrac{1}{2}$                                                           $\frac{1}{2}$

SECTION B

7.  Total number of possible outcomes = 36

    (i)   Doublets are (1, 1) (2, 2) (3, 3) (4, 4) (5, 5) (6, 6)

          Total number of doublets = 6                                                       $\frac{1}{2}$

          $\therefore$  Prob (getting a doublet) $= \dfrac{6}{36}$ or $\dfrac{1}{6}$           $\frac{1}{2}$

    (ii)  Favourable outcomes are (4, 6) (5, 5) (6, 4) i.e., 3                                $\frac{1}{2}$

          $\therefore$  Prob (getting a sum 10) $= \dfrac{3}{36}$ or $\dfrac{1}{12}$           $\frac{1}{2}$

(24)    30/3

8. Let AP : PB = k : 1

$$\therefore \quad \frac{6k+2}{k+1} = 4$$   1
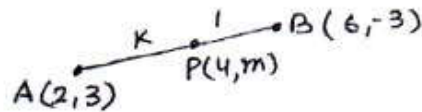


$\Rightarrow \quad k = 1$, ratio is 1 : 1   ½

Hence $m = \dfrac{-3+3}{2} = 0$   ½

9. Total number of outcomes = 98

   (i) Favourable outcomes are 8, 16, 24, ..., 96 i.e., 12   ½

   $\therefore$ Prob (integer is divisible by 8) $= \dfrac{12}{98}$ or $\dfrac{6}{49}$   1

   (ii) Prob (integer is not divisible by 8) $= 1 - \dfrac{6}{49}$

   $= \dfrac{43}{49}$   ½

10. AB = DC and BC = AD

   $\Rightarrow \quad \left.\begin{array}{l} x + y = 30 \\ \text{and} \quad x - y = 14 \end{array}\right\}$   1

   Solving to get $x = 22$ and $y = 8$.   ½ + ½

11. $S = 3 + 6 + 9 + 12 + ... + 24$

   $= 3(1 + 2 + 3 + ... + 8)$   ½

   $= 3 \times \dfrac{8 \times 9}{2}$   1

   $= 108$   ½

12. Let us assume $5 + 3\sqrt{2}$ is a rational number.

   $\therefore \quad 5 + 3\sqrt{2} = \dfrac{p}{q}$ where $q \neq 0$ and p and q are integers.   ½

   $\Rightarrow \quad \sqrt{2} = \dfrac{p - 5q}{3q}$   ½

$\Rightarrow$ $\sqrt{2}$ is a rational number as RHS is rational ½
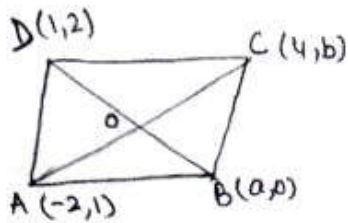
This contradicts the given fact that $\sqrt{2}$ is irrational.

Hence $5 + 3\sqrt{2}$ is an irrational number. ½

## SECTION C

13.



ABCD is a parallelogram

$\therefore$ diagonals AC and BD bisect each other

Therefore

Mid point of BD is same as mid point of AC ½

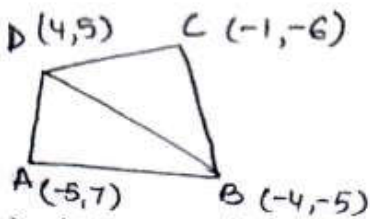$$\Rightarrow \left(\frac{a+1}{2}, \frac{2}{2}\right) = \left(\frac{-2+4}{2}, \frac{b+1}{2}\right)$$ 1

$$\Rightarrow \frac{a+1}{2} = 1 \text{ and } \frac{b+1}{2} = 1$$

$\Rightarrow$ a = 1, b = 1. Therefore length of sides are $\sqrt{10}$ units each. ½+1

OR



Area of quad ABCD = Ar $\triangle$ABD + Ar $\triangle$BCD ½

$$\text{Area of } \triangle ABD = \frac{1}{2}\left|(-5)(-5-5) + (-4)(5-7) + (4)(7+5)\right|$$

= 53 sq units 1

$$\text{Area of } \triangle BCD = \frac{1}{2}\left|(-4)(-6-5) + (-1)(5+5) + 4(-5+6)\right|$$

= 19 sq units 1

Hence area of quad. ABCD = 53 + 19 = 72 sq units ½

**14.** $p(x) = 2x^4 - 9x^3 + 5x^2 + 3x - 1$

$2 + \sqrt{3}$ and $2 - \sqrt{3}$ are zeroes of $p(x)$

$\therefore \quad p(x) = (x - 2 - \sqrt{3})(x - 2 + \sqrt{3}) \times g(x)$

$\qquad = (x^2 - 4x + 1) \, g(x)$       1

$(2x^4 - 9x^3 + 5x^2 + 3x - 1) \div (x^2 - 4x + 1) = 2x^2 - x - 1$       1

$\therefore \quad g(x) = 2x^2 - x - 1$

$\qquad = (2x + 1)(x - 1)$

Therefore other zeroes are $x = -\dfrac{1}{2}$ and $x = 1$

$\therefore \quad$ Therefore all zeroes are $2 + \sqrt{3}, \, 2 - \sqrt{3}, \, -\dfrac{1}{2}$ and $1$       1

**15.** $404 = 2 \times 2 \times 101 = 2^2 \times 101$

$96 = 2 \times 2 \times 2 \times 2 \times 2 \times 3 = 2^5 \times 3$

$\therefore \quad$ HCF of 404 and 96 $= 2^2 = 4$       1

LCM of 404 and 96 $= 101 \times 2^5 \times 3 = 9696$       1

HCF $\times$ LCM $= 4 \times 9696 = 38784$

Also $404 \times 96 = 38784$

Hence HCF $\times$ LCM = Product of 404 and 96.       1

**16.** Correct given, To prove, Figure, Construction       ½ ×4=2

Correct proof       1

**17.**
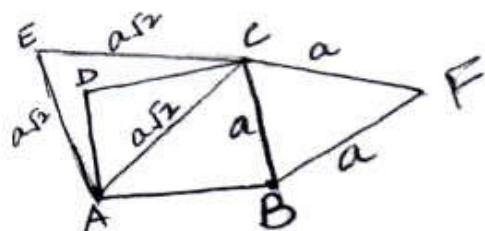
Let the side of the square be 'a' units

$\therefore \quad AC^2 = a^2 + a^2 = 2a^2$

$\Rightarrow \quad AC = \sqrt{2}\,a$ units       1

Area of equilateral $\triangle BCF = \dfrac{\sqrt{3}}{4} a^2$ sq.u       ½

Area of equilateral $\triangle ACE = \dfrac{\sqrt{3}}{4}(\sqrt{2}\,a)^2 = \dfrac{\sqrt{3}}{2}a^2$ sq.u       1

$\Rightarrow \quad$ Area $\triangle BCF = \dfrac{1}{2}$ Ar $\triangle ACE$       ½

(27)   30/3

OR

Let   ΔABC ∼ ΔPQR.

∴   $\dfrac{\text{ar } \Delta ABC}{\text{ar } \Delta PQR} = \dfrac{AB^2}{PQ^2} = \dfrac{BC^2}{QR^2} = \dfrac{AC^2}{PR^2}$      1

Given ar ΔABC = ar ΔPQR

⇒   $\dfrac{AB^2}{PQ^2} = 1 = \dfrac{BC^2}{QR^2} = \dfrac{AC^2}{PR^2}$      1

⇒   AB = PQ, BC = QR, AC = PR

⇒   Therefore ΔABC ≅ ΔPQR. (sss congruence rule)      1

18.   Let the usual speed of the plane be x km/hr.

∴   $\dfrac{1500}{x} - \dfrac{1500}{x+100} = \dfrac{30}{60}$      1

⇒   $x^2 + 100x - 300000 = 0$

⇒   $x^2 + 600x - 500x - 300000 = 0$

⇒   $(x + 600)(x - 500) = 0$      1

  $x \neq -600$,    ∴ x = 500      ½

  Speed of plane = 500 km/hr      ½

19.

| Salary (in thousand Rs) | No. of persons (f) | cf |
|---|---|---|
| 5–10 | 49 | 49 |
| 10–15 | 133 | 182 |
| 15–20 | 63 | 245 |
| 20–25 | 15 | 260 |
| 25–30 | 6 | 266 |
| 30–35 | 7 | 273 |
| 35–40 | 4 | 277 |
| 40–45 | 2 | 279 |
| 45–50 | 1 | 280 |

1

$\dfrac{N}{2} = \dfrac{280}{2} = 140$

Median class is 10–15

$$\text{Median} = l + \frac{h}{f}\left(\frac{N}{2} - C\right)$$

$$= 10 + \frac{5}{133}(140 - 49)$$  1

$$= 10 + \frac{5 \times 91}{133}$$

$$= 13.42$$

Median salary is Rs 13.42 thousand or Rs 13420 (approx)  1

20. Total surface Area of article = CSA of cylinder + CSA of 2 hemispheres

CSA of cylinder = $2\pi rh$

$$= 2 \times \frac{22}{7} \times 3.5 \times 10$$

$$= 220 \text{ cm}^2$$  1

Surface Area of two hemispherical scoops = $4 \times \frac{22}{7} \times 3.5 \times 3.5$

$$= 154 \text{ cm}^2$$  1

Total surface Area of article = 220 + 154

$$= 374 \text{ cm}^2$$  1

OR

Radius of conical heap = 12 m  ½

Volume of rice = $\frac{1}{3} \times \frac{22}{7} \times 12 \times 12 \times 3.5 \text{ m}^3$

$$= 528 \text{ m}^3$$  1

Area of canvas cloth required = $\pi r l$

$$l = \sqrt{12^2 + (3.5)^2} = 12.5 \text{ m}$$  ½

∴  Area of canvas required = $\frac{22}{7} \times 12 \times 12.5$

$$= 471.4 \text{ m}^2$$  1

**21.** Radius of each arc drawn = 6 cm      ½

Area of one quadrant = $(3.14) \times \dfrac{36}{4}$

Area of four quadrants = $3.14 \times 36 = 113.04 \text{ cm}^2$      1

Area of square ABCD = $12 \times 12 = 144 \text{ cm}^2$      1

Hence Area of shaded region = $144 - 113.04$

$= 30.96 \text{ cm}^2$      ½

**22.** $4 \tan \theta = 3$

$\Rightarrow \quad \tan \theta = \dfrac{3}{4}$

$\Rightarrow \quad \sin \theta = \dfrac{3}{5}$ and $\cos \theta = \dfrac{4}{5}$      ½ + ½

$\therefore \quad \dfrac{4 \sin \theta - \cos \theta + 1}{4 \sin \theta + \cos \theta - 1} = \dfrac{4 \times \dfrac{3}{5} - \dfrac{4}{5} + 1}{4 \times \dfrac{3}{5} + \dfrac{4}{5} - 1}$      1

$= \dfrac{13}{11}$      1

**OR**

$\tan 2A = \cot (A - 18°)$

$\Rightarrow \quad 90° - 2A = A - 18°$      1

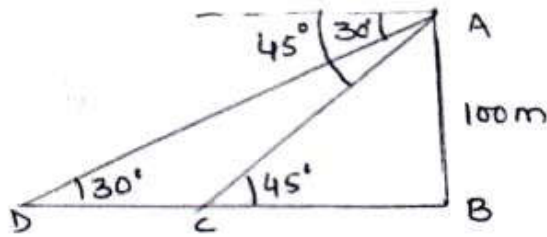$\Rightarrow \quad 3A = 108°$      1

$\Rightarrow \quad A = 36°$      1

# SECTION D

**23.**



Figure     1

Let AB be the tower and ships are at points C and D.

$$\tan 45° = \frac{AB}{BC}$$

$$\Rightarrow \quad \frac{AB}{BC} = 1$$

$$\Rightarrow \quad AB = BC \qquad\qquad 1$$

Also $\tan 30° = \dfrac{1}{\sqrt{3}} = \dfrac{AB}{BC + CD}$

$$\Rightarrow \quad \frac{1}{\sqrt{3}} = \frac{AB}{AB + CD} \qquad\qquad 1$$

$$\Rightarrow \quad AB + CD = \sqrt{3}\,AB$$

$$\Rightarrow \quad CD = AB(\sqrt{3} - 1)$$

$$= 100 \times (1.732 - 1) \qquad\qquad 1$$

$$= 73.2 \text{ m.}$$

**24.** Here $r_1 = 15$ cm, $r_2 = 5$ cm and $h = 24$ cm

(i)    Area of metal sheet = CSA of the bucket + area of lower end

$$= \pi l(r_1 + r_2) + \pi r_2^2 \qquad\qquad 1$$

where $l = \sqrt{24^2 + (15-5)^2} = 26$ cm     1

∴ Surface area of metal sheet $= 3.14(26 \times 20 + 25)$ cm$^2$

$$= 1711.3 \text{ cm}^2 \qquad\qquad 1$$

We should avoid use of plastic because it is non-degradable or similar value.    1

**25.**   LHS $= \dfrac{\sin A - 2\sin^3 A}{2\cos^3 A - \cos A}$

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

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

$$= \tan A \frac{(2\cos^2 A - 1)}{(2\cos^2 A - 1)} \qquad\qquad 1$$

$$= \tan A = \text{RHS} \qquad\qquad 1$$

26. 

| Class | x | f | fx |
|-------|-----|-----|-----|
| 11–13 | 12 | 3 | 36 |
| 13–15 | 14 | 6 | 84 |
| 15–17 | 16 | 9 | 144 |
| 17–19 | 18 | 13 | 234 |
| 19–21 | 20 | f | 20f |
| 21–23 | 22 | 5 | 110 |
| 23–25 | 24 | 4 | 96 |
|       |    | 40 +f | 704 + 20f |

For x          ½

Σf          ½

Σfx          1

$$\text{Mean} = 18 = \frac{704 + 20f}{40 + f}$$          1
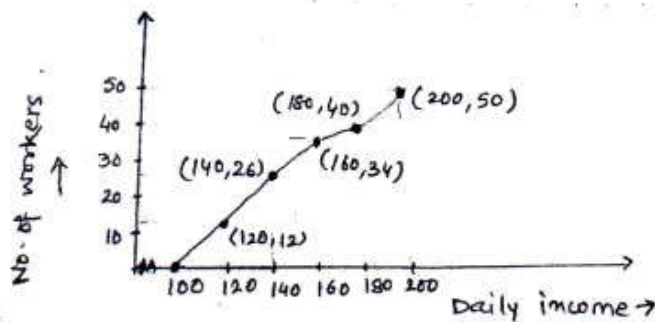
$\Rightarrow \quad 720 + 18f = 704 + 20f$

$\Rightarrow \quad f = 8$          1

**OR**

Cumulative frequency distribution table of less than type is

| Daily income | Cumulative frequency |
|--------------|----------------------|
| Less than 100 | 0 |
| Less than 120 | 12 |
| Less than 140 | 26 |
| Less than 160 | 34 |
| Less than 180 | 40 |
| Less than 200 | 50 |

1½

2½

27. Let the speed of stream be x km/hr.

∴ The speed of the boat upstream = (18 – x) km/hr  ⎫
and Speed of the boat downstream = (18 + x) km/hr ⎬   1

As given in the question,

$$\frac{24}{18-x} - \frac{24}{18+x} = 1$$   1

$\Rightarrow \quad x^2 + 48x - 324 = 0$   ½

$\Rightarrow \quad (x + 54)(x - 6) = 0$

$x \neq -54, \quad \therefore x = 6$   1

∴ Speed of the stream = 6 km/hr.   ½

OR

Let the original average speed of train be x km/hr.

Therefore $\frac{63}{x} + \frac{72}{x+6} = 3$   1½

$\Rightarrow \quad x^2 - 39x - 126 = 0$   1

$\Rightarrow \quad (x - 42)(x + 3) = 0$

$x \neq -3 \quad \therefore x = 42$   1

Original speed of train is 42 km/hr.   ½

28. Let the four consecutive terms of the A.P. be

a – 3d, a – d, a + d, a + 3d.   ½

By given conditions

(a – 3d) + (a – d) + (a + d) + (a + 3d) = 32

$\Rightarrow \quad 4a = 32$

$\Rightarrow \quad a = 8$   1

and $\frac{(a-3d)(a+3d)}{(a-d)(a+d)} = \frac{7}{15}$   1

$\Rightarrow \quad 8a^2 = 128d^2$

$\Rightarrow \quad d^2 = 4$   ½

$\Rightarrow$   $d = \pm 2$ 1

$\therefore$ Numbers are 2, 6, 10, 14 or 14, 10, 6, 2.

**29.**   Correct Construction of $\Delta ABC$ 2

Correct construction of similar to ~~$\Delta ABC$~~. triangle. 2
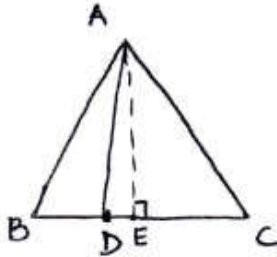
**30.**



Draw $AE \perp BC$

$\Delta AEB \cong \Delta AEC$   (RHS congruence rule)

$\therefore$   $BE = EC = \dfrac{1}{2}BC = \dfrac{1}{2}AB$ 1

Let $AB = BC = AC = x$

Now $BE = \dfrac{x}{2}$  and  $DE = BE - BD$

$$= \dfrac{x}{2} - \dfrac{x}{3}$$

$$= \dfrac{x}{6}$$ 1

Now   $AB^2 = AE^2 + BE^2$                ...(1)

and   $AD^2 = AE^2 + DE^2$                ...(2) } 1

From (1) and (2)   $AB^2 - AD^2 = BE^2 - DE^2$

$\Rightarrow$   $x^2 - AD^2 = \left(\dfrac{x}{2}\right)^2 - \left(\dfrac{x}{6}\right)^2$

$\Rightarrow$   $AD^2 = x^2 - \dfrac{x^2}{4} + \dfrac{x^2}{36}$

$\Rightarrow$   $AD^2 = \dfrac{28}{36}x^2$ 1

$\Rightarrow$   $9AD^2 = 7AB^2$

**OR**

Given, to Prove, Construction and Figure $\frac{1}{2} \times 4 = 2$

Correct Proof 2

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