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Secondary School Certificate Examination

March 2016

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. In question (s) on differential equations, constant of integration has to be written.

5. 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.

6. A full scale of marks - 0 to 100 has to be used. Please do not hesitate to award full marks if the answer deserves it.

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

8. 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. For $\angle ACB = 90°$ $\frac{1}{2}$

$\angle PCA = 60°$ $\frac{1}{2}$

2. $2(2k - 1) = k + 9 + 2k + 7$ $\frac{1}{2}$

$k = 18$ $\frac{1}{2}$

3. $\frac{l}{2.5} = 2$ $\frac{1}{2}$

$l = 5$ m $\frac{1}{2}$

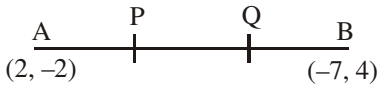
4. No. of red cards and queens: 28 $\frac{1}{2}$

Required Probability: $\frac{24}{52}$ or $\frac{6}{13}$ $\frac{1}{2}$

SECTION B

5. $2(-5)^2 + p(-5) - 15 = 0 \Rightarrow p = 7$ 1

$7x^2 + 7x + k = 0$ gives $49 - 28k = 0 \Rightarrow k = \frac{7}{4}$ 1

6. 

P divides AB in 1 : 2 $\frac{1}{2}$

$\therefore$ Coords of P are: (–1, 0) 1

Q is mid-point of PB

$\therefore$ Coords of Q are: (–4, 2) $\frac{1}{2}$

7. AP = AS, BP = BQ, CR = CQ and DR = DS 1

$AP + BP + CR + DR = AS + BQ + CQ + DS \Rightarrow AB + CD = AD + BC$ 1

8. Let the point be A(3, 0), B(6, 4), C(–1, 3)

$AB = \sqrt{9+16} = 5,\ BC = \sqrt{49+1} = 5\sqrt{2},\ AC = \sqrt{16+9} = 5$ $1\frac{1}{2}$

AB = AC and $AB^2 + AC^2 = BC^2$: ΔABC isosceles, right Δ $\frac{1}{2}$

9. $a + 3d = 0 \Rightarrow a = -3d$ $\frac{1}{2}$

$a_{25} = a + 24d = 21d$ $\frac{1}{2}$

$3a_{11} = 3(a + 10d) = 3(7d) = 21d$ 1

10. Let $\angle TOP = \theta \therefore \cos\theta = \frac{OT}{OP} = \frac{r}{2r} = \frac{1}{2} \therefore \theta = 60°$ Hence $\angle TOS = 120°$ 1

In ΔOTS, $OT = OS \Rightarrow \angle OTS = \angle OST = 30°$ 1

SECTION C

11. $BC^2 = AB^2 - AC^2 = 169 - 144 = 25 \therefore BC = 5cm$ 1

Area of the shaded region = Area of semicircle – area of rt. ΔABC

$$= \frac{1}{2}(3.14)\left(\frac{13}{2}\right)^2 - \frac{1}{2}.12\times 5$$ 1

$$= 66.33 - 30 = 36.33\ cm^2$$ 1

12. Area of canvas needed $= 2\times\frac{22}{7}\times(1.5)\times 2.1 + \frac{22}{7}\times 1.5\times 2.8$ $1\frac{1}{2}$

$$= \frac{22}{7}[6.3 + 4.2] = \frac{22}{7}\times 10.5 = 33\ m^2$$ 1

cost = 33 × 500 = ₹ 16500 $\frac{1}{2}$

13. PA = PB or $(PA)^2 = (PB)^2$ 1

$(a + b - x)^2 + (b - a - y)^2 = (a - b - x)^2 + (a + b - y)^2$ 1

$(a + b)^2 + x^2 - 2ax - 2bx + (b - a)^2 + y^2 - 2by + 2ay$

$= (a - b)^2 + x^2 - 2ax + 2bx + (a + b)^2 + y^2 - 2ay - 2by$

$\Rightarrow$ $4ay = 4bx$ or $bx = ay$ 1

14. Shaded area = $\pi(14^2 - 7^2) \times \frac{320}{360}$ 2

$= \frac{22}{7} \times 147 \times \frac{8}{9}$ $\frac{1}{2}$

$= \frac{1232}{3} = 410.67 \text{ cm}^2$ $\frac{1}{2}$

15. $\frac{Sn}{S_n'} = \frac{n/2\,(2a + (n-1)d)}{n/2\,(2a' + (n-1)\,d')} = \frac{7n+1}{4n+27}$ 1

$= \frac{a + \frac{n-1}{2} d}{a' + \frac{n-1}{2} d'} = \frac{7n+1}{An+27}$ ...(i) $\frac{1}{2}$

Since $\frac{t_m}{t_m'} = \frac{a + (m-1)\,d}{a + (m-1)\,d'}$, So replacing $\frac{n-1}{2}$ by m – 1 i.e. n = 2m – 1 in (i) 1

$\frac{t_m}{t_m'} = \frac{a + (m-1)\,d}{a' + (m-1)\,d'} = \frac{7\,(2m-1)+1}{4\,(2m-1)+27} = \frac{14m-6}{8m+23}$ $\frac{1}{2}$

16. Here $3(x - 3 + x - 1) = 2(x - 1)\,(x - 2)\,(x - 3)$ $1\frac{1}{2}$

$\Rightarrow$ $3(2x - 4) = 2(x - 1)\,(x - 2)\,(x - 3)$ $\frac{1}{2}$

$\Rightarrow$ $3 = (x - 1)\,(x - 3)$ i.e. $x^2 - 4x = 0$

$\therefore$ $x = 0,\ x = 4$ 1

17. Volume of water in conical vessel = $\frac{1}{3} \times \frac{22}{7} \times 25 \times 24 \text{ cm}^2$ 1

$\therefore$ $\frac{1}{3} \times \frac{22}{7} \times 25 \times 24 = \frac{22}{7} \times 10 \times 10 \times h$ $1\frac{1}{2}$

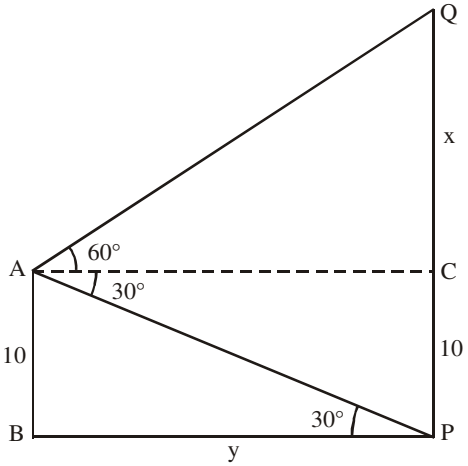
$\Rightarrow$ $h = 2$ cm $\frac{1}{2}$

18. Volume of sphere = $\frac{4}{3} \pi.(6)^3.\text{cm}^3$ 1

$\therefore \quad \pi r^2 \frac{32}{9} = \frac{4}{3}\pi (6)^3$ $1\frac{1}{2}$

$\Rightarrow \quad r = 9$ cm. $\frac{1}{2}$

19.



Correct Figure $\frac{1}{2}$

In ΔABP, $\frac{y}{10} = \cot 30° = \sqrt{3}$

$\therefore \quad y = 10\sqrt{3}$ m 1

In ΔACQ, $\frac{x}{y} = \tan 60° = \sqrt{3}$

$x = \sqrt{3}\left(10\sqrt{3}\right) = 30$ m 1

$\therefore$ Height of hill = 30 + 10 = 40 m $\frac{1}{2}$

20. Set of possible outcomes is

{HHH, HHT, HTH, THH, HTT, THT, TTH, TTT}

(i) P(exactly 2 heads) = 3/8 1

(ii) P(at least 2 heads) = 4/8 or 1/2 1

(iii) P(at least 2 tails) = 4/8 or 1/2 1

SECTION D

21. Slant height of conical part = $\sqrt{(2.8)^2 + (2.1)^2} = 3.5$ m $\frac{1}{2}$

Area of canvas/tent $= 2 \times \frac{22}{7} \times 2.8 \times 3.5 + \frac{22}{7} \times 2.8 \times 3.5 \text{ m}^2$

$= 92.4 \text{ m}^2$ 1

Cost of 1500 tents = 1500 × 92.4 × 120 = ₹ 16632000 1

Share of each school $= \frac{1}{50} \times 1663200$

= ₹ 332640 /- $\frac{1}{2}$

"Helping the needy" 1

22. Correct Given, To prove, Construction and Figure $4 \times \frac{1}{2} = 2$

Correct proof 2

23. Correct construction 4

24. AC is tangent to circle with centre 0,

Thus $\angle ACO = 90°$ 1

$\therefore$ $\Delta AO'D \sim \Delta AOC$ 1

$\Rightarrow$ $\frac{AO'}{AO} = \frac{DO'}{CO}$ 1

$\therefore$ $\frac{DO'}{CO} = \frac{r}{3r} = \frac{1}{3}$ 1

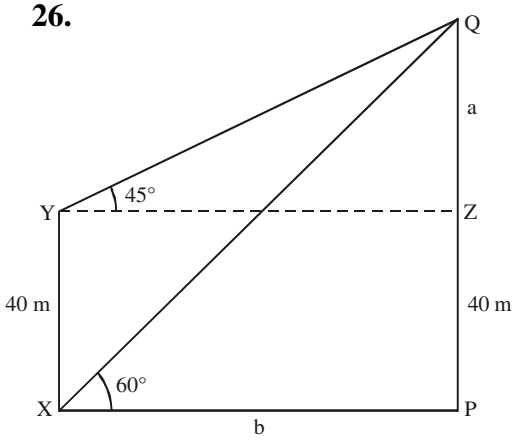
25. $(x + 4)(x + 2 + 2x + 2) = 4(x + 1)(x + 2)$ 1

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

$\Rightarrow$ $x^2 - 4x - 8 = 0$ $1\frac{1}{2}$

$\Rightarrow$ $x = \frac{4 \pm \sqrt{16 + 32}}{2} = 2 \pm 2\sqrt{3}$ $1\frac{1}{2}$

26.



Correct Figure 1

In ΔYZQ, $\frac{a}{YZ} = \tan 45° = 1$

$\Rightarrow$ YZ = a i.e. a = b 1

In ΔQPX, $\frac{a + 40}{b} = \frac{a + 40}{a} = \tan 60° = \sqrt{3}$

$\therefore$ $(\sqrt{3} - 1)\,a = 40$ or $a = \frac{40}{\sqrt{3} - 1} = 20(\sqrt{3} + 1)$

$= 20(2.73) = 54.60$ m 1

$\therefore$ PX = 54.6 m

PQ = 54.6 + 40 = 94.6m 1

27. Sum of numbers preceeding X

$$= \frac{(X-1)\,X}{2} \qquad 1\frac{1}{2}$$

Sum of numbers following $X = \frac{(49)\,(50)}{2} - \frac{(X-1)}{2} - X$

$$= \frac{2450 - X^2 - X}{2} \qquad 1\frac{1}{2}$$

$\therefore \quad \frac{(X-1)\,X}{2} = \frac{2450 - X^2 - X}{2}$

$\Rightarrow \quad 2X^2 = 2450$

$X^2 = 1225$

$X = 35 \qquad 1$

[Since there is a typographic error in the question, which makes it unsolvable, hence 4 marks be given to each student]

28. Coords of D are: $\left(\frac{1\,(1) + 2(4)}{3}\right), \left(\frac{1(5) + 2(6)}{3}\right)$ i.e. $\left(3, \frac{17}{3}\right)$ $\frac{1}{2}$

Coords of E are: $\left(\frac{1(7) + 2(4)}{3}, \frac{1(2) + 2(6)}{3}\right)$ i.e. $\left(5, \frac{14}{3}\right)$ $\frac{1}{2}$

ar. $\Delta ADE = \frac{1}{2}\left[4(1) + 3\left(\frac{14}{3} - 6\right) + 5\left(6 - \frac{17}{3}\right)\right] = \frac{5}{6}$ 1

ar. $\Delta ABC = \frac{1}{2}[4(3) + 1(-4) + 7(1)] = \frac{15}{2}$ 1

ar. ΔADE: ar. $\Delta ABC = \frac{5}{6} : \frac{15}{2}$ or $1:9$ 1

29. x can be any one of 1, 2, 3 or 4.

y can be any one of 1, 4, 9 of 16

Total number of cases of xy = 16 $1\frac{1}{2}$

Number of cases, where product is less than 16 = 8 $1\frac{1}{2}$

{1, 4, 9, 2, 8, 3, 12, 4}

$\therefore$ Required Probability = $\frac{8}{16}$ or $\frac{1}{2}$ 1

30. Length of are $\overset{\frown}{AP} = 2\pi r \frac{\theta}{360}$ or $\frac{\pi r\theta}{180}$ ...(i) 1

$\frac{AB}{r} = \tan\theta \Rightarrow AB = r\tan\theta$ ...(ii) $\frac{1}{2}$

$\frac{OB}{r} = \sec\theta \Rightarrow OB = r\sec\theta$ $\frac{1}{2}$

$PB = OB - r = r\sec\theta - r$ ...(iii) 1

Perimeter = $AB + PB + \overset{\frown}{AP}$

$= r\tan\theta + r\sec\theta - r + \frac{\pi r\theta}{180}$ 1

or $r\left[\tan\theta + \sec\theta - 1 + \frac{\pi\theta}{180}\right]$

31. let x km/h be the speed of the stream

$\therefore \quad \frac{32}{24-x} - \frac{32}{24+x} = 1$ 2

$\Rightarrow \quad 32(2x) = (24 - x)(24 + x)$

$x^2 + 64x - 576 = 0$ 1

$(x + 72)(x - 8) = 0 \Rightarrow x = 8$

$\therefore$ Speed of stream = 8 km/h. 1

QUESTION PAPER CODE 30/2
EXPECTED ANSWER/VALUE POINTS

SECTION A

1. $\frac{l}{2.5} = 2$ $\frac{1}{2}$

$l = 5$ m $\frac{1}{2}$

2. $2(2k - 1) = k + 9 + 2k + 7$ $\frac{1}{2}$

$k = 18$ $\frac{1}{2}$

3. For $\angle ACB = 90°$ $\frac{1}{2}$

$\angle PCA = 60°$ $\frac{1}{2}$

4. No. of red cards and queens: 28 $\frac{1}{2}$

Required Probability: $\frac{24}{52}$ or $\frac{6}{13}$ $\frac{1}{2}$

SECTION B

5. AP = AS, BP = BQ, CR = CQ and DR = DS 1

$AP + BP + CR + DR = AS + BQ + CQ + DS \Rightarrow AB + CD = AD + BC$ 1

6. $a + 3d = 0 \Rightarrow a = -3d$ $\frac{1}{2}$

$a_{25} = a + 24d = 21d$ $\frac{1}{2}$

$3a_{11} = 3(a + 10d) = 3(7d) = 21d$ 1

7. Let $\angle TOP = \theta \therefore \cos\theta = \frac{OT}{OP} = \frac{r}{2r} = \frac{1}{2} \therefore \theta = 60°$ Hence $\angle TOS = 120°$ 1

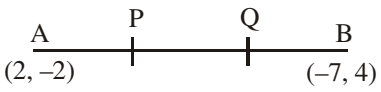
In ΔOTS, $OT = OS \Rightarrow \angle OTS = \angle OST = 30°$ 1

8. Let the point be A(3, 0), B(6, 4), C(–1, 3)

$AB = \sqrt{9+16} = 5$, $BC = \sqrt{49+1} = 5\sqrt{2}$, $AC = \sqrt{16+9} = 5$ $1\frac{1}{2}$

AB = AC and $AB^2 + AC^2 = BC^2$: ΔABC isosceles, right Δ $\frac{1}{2}$

9.



P divides AB in 1 : 2 $\frac{1}{2}$

$\therefore$ Coords of P are: (–1, 0) 1

Q is mid-point of PB

$\therefore$ Coords of Q are: (–4, 2) $\frac{1}{2}$

10. $\sqrt{2x+9} = 13 - x$ ...(i)

$\Rightarrow$ $2x + 9 = 169 + x^2 - 26x$

or $x^2 - 28x + 160 = 0$ i.e. $(x - 20)(x - 8) = 0$ 1

$x = 20, 8.$ $\frac{1}{2}$

$x = 20$ does not satisfy (i) $\therefore$ $x = 8$ $\frac{1}{2}$

SECTION C

11. PA = PB or $(PA)^2 = (PB)^2$ 1

$(a + b - x)^2 + (b - a - y)^2 = (a - b - x)^2 + (a + b - y)^2$ 1

$(a + b)^2 + x^2 - 2ax - 2bx + (b - a)^2 + y^2 - 2by + 2ay$

$= (a - b)^2 + x^2 - 2ax + 2bx + (a + b)^2 + y^2 - 2ay - 2by$

$\Rightarrow$ $4ay = 4bx$ or $bx = ay$ 1

12. Volume of water in conical vessel $= \frac{1}{3} \times \frac{22}{7} \times 25 \times 24\ cm^2$ 1

$\therefore$ $\frac{1}{3} \times \frac{22}{7} \times 25 \times 24 = \frac{22}{7} \times 10 \times 10 \times h$ $1\frac{1}{2}$

$\Rightarrow$ $h = 2$ cm $\frac{1}{2}$

13. $BC^2 = AB^2 - AC^2 = 169 - 144 = 25 \therefore BC = 5\text{cm}$ 1

Area of the shaded region = Area of semicircle – area of rt. ΔABC

$$= \frac{1}{2}(3.14)\left(\frac{13}{2}\right)^2 - \frac{1}{2}.12\times 5 \quad 1$$

$$= 66.33 - 30 = 36.33 \text{ cm}^2 \quad 1$$

14. Volume of sphere $= \frac{4}{3}\pi.(6)^3.\text{cm}^3$ 1

$$\therefore \quad \pi r^2 \frac{32}{9} = \frac{4}{3}\pi(6)^3 \quad 1\frac{1}{2}$$

$$\Rightarrow \quad r = 9 \text{ cm.} \quad \frac{1}{2}$$

15. Area of canvas needed $= 2\times\frac{22}{7}\times(1.5)\times 2.1 + \frac{22}{7}\times 1.5\times 2.8$ $1\frac{1}{2}$

$$= \frac{22}{7}[6.3+4.2] = \frac{22}{7}\times 10.5 = 33\,\text{m}^2 \quad 1$$

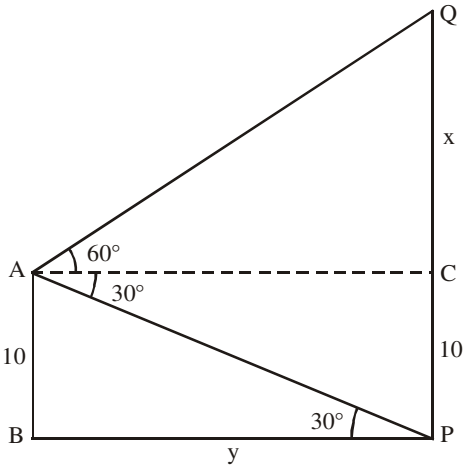
$$\text{cost} = 33 \times 500 = ₹\ 16500 \quad \frac{1}{2}$$

16. Shaded area $= \pi(14^2 - 7^2)\times\frac{320}{360}$ 2

$$= \frac{22}{7}\times 147\times\frac{8}{9} \quad \frac{1}{2}$$

$$= \frac{1232}{3} = 410.67\,\text{cm}^2 \quad \frac{1}{2}$$

17.



Correct Figure $\frac{1}{2}$

In ΔABP, $\frac{y}{10} = \cot 30° = \sqrt{3}$

$\therefore$ $y = 10\sqrt{3}$ m 1

In ΔACQ, $\frac{x}{y} = \tan 60° = \sqrt{3}$

$x = \sqrt{3}\,(10\sqrt{3}) = 30$ m 1

$\therefore$ Height of hill = 30 + 10 = 40 m $\frac{1}{2}$

18. Let the three digits be a – d, a, a + d $\frac{1}{2}$

$\therefore$ $a - d + a + a + d = 3a = 15 \Rightarrow a = 5$ $\frac{1}{2}$

Number is: $100(a - d) + 10(a) + (a + d)$

i.e., $111a - 99d$.

Number, on reversing the digits is: $100(a + d) + 10a + (a - d)$

i.e., $111a + 99d$

$\therefore$ $(111a - 99d) - (111a + 99d) = 594$ 1

$\Rightarrow$ $d = -3$ $\frac{1}{2}$

$\therefore$ Number is 852 $\frac{1}{2}$

19. Roots are equal $\therefore$ $(b - c)^2 - 4(c - a)(a - b) = 0$ 1

$\Rightarrow$ $b^2 + c^2 - 2bc - 4(ac - a^2 - bc + ab) = 0$

$\therefore$ $(b^2 + c^2 + 2bc) - 4a(b + c) + 4a^2 = 0$ $\frac{1}{2}$

$[(b + c) - 2a]^2 = 0$ 1

$b + c - 2a = 0$ or $b + c = 2a$ $\frac{1}{2}$

20. Remaining cards = 52 – 6 = 46 $\frac{1}{2}$

P (black king) = $\frac{2}{46}$ or $\frac{1}{23}$ 1

P (a card of red colour) = $\frac{20}{46}$ or $\frac{10}{23}$ 1

P (a black card) = $\frac{26}{46}$ or $\frac{13}{23}$ $\frac{1}{2}$

SECTION D

21. Slant height of conical part = $\sqrt{(2.8)^2 + (2.1)^2} = 3.5$ m $\frac{1}{2}$

Area of canvas/tent = $2 \times \frac{22}{7} \times 2.8 \times 3.5 + \frac{22}{7} \times 2.8 \times 3.5$ m^2

= 92.4 m^2 1

Cost of 1500 tents = 1500 × 92.4 × 120 = ₹ 16632000 1

Share of each school = $\frac{1}{50} \times 1663200$

= ₹ 332640 /- $\frac{1}{2}$

"Helping the needy" 1

22. AC is tangent to circle with centre 0,

Thus $\angle ACO = 90°$ 1

$\therefore$ $\Delta AO'D \sim \Delta AOC$ 1

$\Rightarrow$ $\frac{AO'}{AO} = \frac{DO'}{CO}$ 1

$\therefore$ $\frac{DO'}{CO} = \frac{r}{3r} = \frac{1}{3}$ 1

23. x can be any one of 1, 2, 3 or 4.

y can be any one of 1, 4, 9 of 16

Total number of cases of xy = 16 $1\frac{1}{2}$

Number of cases, where product is less than 16 = 8 $1\frac{1}{2}$

{1, 4, 9, 2, 8, 3, 12, 4}

$\therefore$ Required Probability = $\frac{8}{16}$ or $\frac{1}{2}$ 1

24. Coords of D are: $\left(\frac{1(1) + 2(4)}{3}\right), \left(\frac{1(5) + 2(6)}{3}\right)$ i.e. $\left(3, \frac{17}{3}\right)$ $\frac{1}{2}$

Coords of E are: $\left(\frac{1(7) + 2(4)}{3}, \frac{1(2) + 2(6)}{3}\right)$ i.e. $\left(5, \frac{14}{3}\right)$ $\frac{1}{2}$

ar. $\Delta ADE = \frac{1}{2}\left[4(1) + 3\left(\frac{14}{3} - 6\right) + 5\left(6 - \frac{17}{3}\right)\right] = \frac{5}{6}$ 1

ar. $\Delta ABC = \frac{1}{2}[4(3) + 1(-4) + 7(1)] = \frac{15}{2}$ 1

ar. ΔADE: ar. $\Delta ABC = \frac{5}{6} : \frac{15}{2}$ or $1 : 9$ 1

25. Length of arc $\overset{\frown}{AP} = 2\pi r \frac{\theta}{360}$ or $\frac{\pi r\theta}{180}$ ...(i) 1

$\frac{AB}{r} = \tan\theta \Rightarrow AB = r \tan\theta$ ...(ii) $\frac{1}{2}$

$\frac{OB}{r} = \sec\theta \Rightarrow OB = r \sec\theta$ $\frac{1}{2}$

$PB = OB - r = r \sec\theta - r$ ...(iii) 1

Perimeter $= AB + PB + \overset{\frown}{AP}$

$= r\tan\theta + r\sec\theta - r + \frac{\pi r\theta}{180}$ 1

or $r\left[\tan\theta + \sec\theta - 1 + \frac{\pi\theta}{180}\right]$

26. Sum of numbers preceeding X

$= \frac{(X-1)X}{2}$ $1\frac{1}{2}$

Sum of numbers following $X = \frac{(49)(50)}{2} - \frac{(X-1)}{2} - X$

$= \frac{2450 - X^2 - X}{2}$ $1\frac{1}{2}$

$\therefore \quad \frac{(X-1)X}{2} = \frac{2450 - X^2 - X}{2}$

$\Rightarrow \quad 2X^2 = 2450$

$X^2 = 1225$

$X = 35$ 1

[Since there is a typographic error in the question, which makes it unsolvable, hence 4 marks be given to each student]

27. let x km/h be the speed of the stream

$\therefore \quad \frac{32}{24-x} - \frac{32}{24+x} = 1$ 2

$\Rightarrow \quad 32(2x) = (24 - x)(24 + x)$

$x^2 + 64x - 576 = 0$ 1

$(x + 72)(x - 8) = 0 \Rightarrow x = 8$

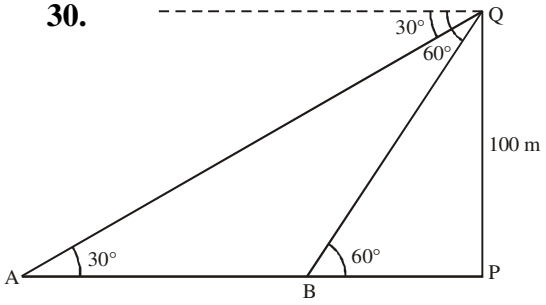
$\therefore$ Speed of stream = 8 km/h. 1

28. Correct Construction 4

29. Correct given, To Prove, Construction, Figure $\frac{1}{2} \times 4 = 2$

Correct Proof 2

30.



Correct Figure 1

In ΔPBQ, $\frac{PB}{100} = \cot 60° = \frac{1}{\sqrt{3}}$

$\Rightarrow \quad PB = \frac{100}{\sqrt{3}}$ or $\frac{100\sqrt{3}}{3}$ 1

In ΔPAQ,

$\frac{PA}{100} = \cot 30° = \sqrt{3}$

$PA = 100\sqrt{3}$ 1

$\therefore \quad AB = 100\sqrt{3} - \frac{100\sqrt{3}}{3} = \frac{200\sqrt{3}}{3}$

$= \frac{200(1.73)}{3} = 115.3 \text{ m}$ 1

31. Area of rectangle = x (x – 3), where x is the length $\frac{1}{2}$

Area of Isosceles $\Delta = \frac{1}{2}(x-3)(12)$ $\frac{1}{2}$

$\therefore \quad x(x-3) - \frac{1}{2}(x-3)(12) = 4$

$x^2 - 9x + 14 = 0$ or $(x - 7)(x - 2) = 0$ 1+1

x = 7m. (rejecting x = 2)

$\therefore$ Length = 7m breadth = 4m 1

QUESTION PAPER CODE 30/3

EXPECTED ANSWER/VALUE POINTS

SECTION A

1. No. of red cards and queens: 28 $\frac{1}{2}$

Required Probability: $\frac{24}{52}$ or $\frac{6}{13}$ $\frac{1}{2}$

2. $\frac{l}{2.5} = 2$ $\frac{1}{2}$

$l = 5$ m $\frac{1}{2}$

3. For $\angle ACB = 90°$ $\frac{1}{2}$

$\angle PCA = 60°$ $\frac{1}{2}$

4. $2(2k - 1) = k + 9 + 2k + 7$ $\frac{1}{2}$

$k = 18$ $\frac{1}{2}$

SECTION B

5. AP = AS, BP = BQ, CR = CQ and DR = DS 1

$AP + BP + CR + DR = AS + BQ + CQ + DS \Rightarrow AB + CD = AD + BC$ 1

6. Let the point be A(3, 0), B(6, 4), C(–1, 3)

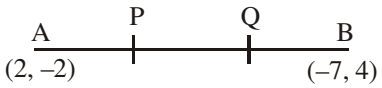
$AB = \sqrt{9+16} = 5$, $BC = \sqrt{49+1} = 5\sqrt{2}$, $AC = \sqrt{16+9} = 5$ $1\frac{1}{2}$

AB = AC and $AB^2 + AC^2 = BC^2$: ΔABC isosceles, right Δ $\frac{1}{2}$

7. $a + 3d = 0 \Rightarrow a = -3d$ $\frac{1}{2}$

$a_{25} = a + 24d = 21d$ $\frac{1}{2}$

$3a_{11} = 3(a + 10d) = 3(7d) = 21d$ 1

8. 

P divides AB in 1 : 2 $\frac{1}{2}$

$\therefore$ Coords of P are: (–1, 0) 1

Q is mid-point of PB

$\therefore$ Coords of Q are: (–4, 2) $\frac{1}{2}$

9. Let $\angle TOP = \theta \therefore \cos\theta = \frac{OT}{OP} = \frac{r}{2r} = \frac{1}{2} \therefore \theta = 60°$ Hence $\angle TOS = 120°$ 1

In ΔOTS, $OT = OS \Rightarrow \angle OTS = \angle OST = 30°$ 1

10. $\sqrt{6x+7} = (2x - 7)$ ...(i)

$\Rightarrow \quad 6x + 7 = 4x^2 - 28x + 49$

$\Rightarrow \quad 2x^2 - 17x + 21 = 0$

$\Rightarrow \quad (2x - 3)(x - 7) = 0$ 1

$x = 3/2, \ x = 7$ $\frac{1}{2}$

$x = \frac{3}{2}$ does not satisfy (i) $\therefore x = 7$ $\frac{1}{2}$

SECTION C

11. Volume of water in conical vessel $= \frac{1}{3} \times \frac{22}{7} \times 25 \times 24 \text{ cm}^2$ 1

$\therefore \quad \frac{1}{3} \times \frac{22}{7} \times 25 \times 24 = \frac{22}{7} \times 10 \times 10 \times h$ $1\frac{1}{2}$

$\Rightarrow \quad h = 2$ cm $\frac{1}{2}$

12. $BC^2 = AB^2 - AC^2 = 169 - 144 = 25 \therefore BC = 5$cm 1

Area of the shaded region = Area of semicircle – area of rt. ΔABC

$$= \frac{1}{2}(3.14)\left(\frac{13}{2}\right)^2 - \frac{1}{2}.12 \times 5$$ 1

$$= 66.33 - 30 = 36.33 \text{ cm}^2$$ 1

13. PA = PB or $(PA)^2 = (PB)^2$ 1

$(a + b - x)^2 + (b - a - y)^2 = (a - b - x)^2 + (a + b - y)^2$ 1

$(a + b)^2 + x^2 - 2ax - 2bx + (b - a)^2 + y^2 - 2by + 2ay$

$= (a - b)^2 + x^2 - 2ax + 2bx + (a + b)^2 + y^2 - 2ay - 2by$

$\Rightarrow$ $4ay = 4bx$ or $bx = ay$ 1

14. Area of canvas needed $= 2 \times \frac{22}{7} \times (1.5) \times 2.1 + \frac{22}{7} \times 1.5 \times 2.8$ $1\frac{1}{2}$

$= \frac{22}{7}[6.3 + 4.2] = \frac{22}{7} \times 10.5 = 33\ m^2$ 1

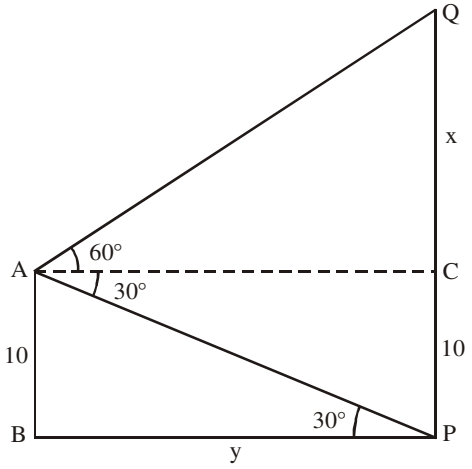
cost $= 33 \times 500 = ₹\ 16500$ $\frac{1}{2}$

15. Volume of sphere $= \frac{4}{3}\pi.(6)^3.cm^3$ 1

$\therefore$ $\pi r^2 \frac{32}{9} = \frac{4}{3}\pi(6)^3$ $1\frac{1}{2}$

$\Rightarrow$ $r = 9$ cm. $\frac{1}{2}$

16.



Correct Figure $\frac{1}{2}$

In ΔABP, $\frac{y}{10} = \cot 30° = \sqrt{3}$

$\therefore$ $y = 10\sqrt{3}$ m 1

In ΔACQ, $\frac{x}{y} = \tan 60° = \sqrt{3}$

$x = \sqrt{3}(10\sqrt{3}) = 30$ m 1

$\therefore$ Height of hill = 30 + 10 = 40 m $\frac{1}{2}$

17. Shaded area = $\pi(14^2 - 7^2) \times \frac{320}{360}$ 2

$= \frac{22}{7} \times 147 \times \frac{8}{9}$ $\frac{1}{2}$

$= \frac{1232}{3} = 410.67 \text{ cm}^2$ $\frac{1}{2}$

18. (i) Number div. by 9 and perfect squares

are {9, 36, 81} i.e. 3 1

$\therefore$ Req. Prob. = $\frac{3}{100}$ $\frac{1}{2}$

(ii) Prime numbers greater than 80 1

are 83, 89 and 97

$\therefore$ Req. Prob. = $\frac{3}{100}$ $\frac{1}{2}$

19. Let the number be x, x + 1, x + 2 $\frac{1}{2}$

$\therefore$ $(x + 1)^2 - [(x + 2)^2 - x^2] = 60$ 1

$x^2 - 2x - 63 = 0$ or $(x - 9)(x + 7) = 0$ 1

$\Rightarrow$ $x = 9$

$\therefore$ Numbers are 9, 10, 11 $\frac{1}{2}$

20. $S_1 = \frac{n}{2}[2 + (n-1)1]$ or $\frac{n}{2}[n+1]$ $\frac{1}{2}$

$S_2 = \frac{n}{2}[2 + (n-1)2]$ or $\frac{n}{2}(2n) = n^2$ $\frac{1}{2}$

$S_3 = \frac{n}{2}[2 + (n-1)3]$ or $\frac{n}{2}(3n-1)$ $\frac{1}{2}$

$S_1 + S_3 = \frac{n}{2}[4n] = 2n^2 = 2.S_2$ $1\frac{1}{2}$

SECTION D

21. Slant height of conical part = $\sqrt{(2.8)^2 + (2.1)^2} = 3.5$ m $\frac{1}{2}$

Area of canvas/tent = $2 \times \frac{22}{7} \times 2.8 \times 3.5 + \frac{22}{7} \times 2.8 \times 3.5$ m^2

= 92.4 m^2 1

Cost of 1500 tents = 1500 × 92.4 × 120 = ₹ 16632000 1

Share of each school = $\frac{1}{50} \times 1663200$

= ₹ 332640 /- $\frac{1}{2}$

"Helping the needy" 1

22. Sum of numbers preceeding X

$$= \frac{(X-1)\,X}{2} \qquad 1\frac{1}{2}$$

Sum of numbers following X = $\frac{(49)\,(50)}{2} - \frac{(X-1)}{2} - X$

$$= \frac{2450 - X^2 - X}{2} \qquad 1\frac{1}{2}$$

$\therefore$ $\frac{(X-1)\,X}{2} = \frac{2450 - X^2 - X}{2}$

$\Rightarrow$ $2X^2 = 2450$

$X^2 = 1225$

$X = 35$ 1

[Since there is a typographic error in the question, which makes it unsolvable, hence 4 marks be given to each student]

23. Coords of D are: $\left(\frac{1\,(1) + 2(4)}{3}\right), \left(\frac{1(5) + 2(6)}{3}\right)$ i.e. $\left(3, \frac{17}{3}\right)$ $\frac{1}{2}$

Coords of E are: $\left(\frac{1(7) + 2(4)}{3}, \frac{1(2) + 2(6)}{3}\right)$ i.e. $\left(5, \frac{14}{3}\right)$ $\frac{1}{2}$

ar. $\Delta ADE = \frac{1}{2}\left[4(1) + 3\left(\frac{14}{3} - 6\right) + 5\left(6 - \frac{17}{3}\right)\right] = \frac{5}{6}$ 1

ar. $\Delta ABC = \frac{1}{2}[4(3)+1(-4)+7(1)] = \frac{15}{2}$ 1

ar. ΔADE: ar. $\Delta ABC = \frac{5}{6}:\frac{15}{2}$ or $1:9$ 1

24. AC is tangent to circle with centre 0,

Thus $\angle ACO = 90°$ 1

$\therefore$ $\Delta AO'D \sim \Delta AOC$ 1

$\Rightarrow$ $\frac{AO'}{AO} = \frac{DO'}{CO}$ 1

$\therefore$ $\frac{DO'}{CO} = \frac{r}{3r} = \frac{1}{3}$ 1

25. let x km/h be the speed of the stream

$\therefore$ $\frac{32}{24-x} - \frac{32}{24+x} = 1$ 2

$\Rightarrow$ $32(2x) = (24 - x)(24 + x)$

$x^2 + 64x - 576 = 0$ 1

$(x + 72)(x - 8) = 0 \Rightarrow x = 8$

$\therefore$ Speed of stream = 8 km/h. 1

26. Length of are $\overset{\frown}{AP} = 2\pi r\frac{\theta}{360}$ or $\frac{\pi r\theta}{180}$ ...(i) 1

$\frac{AB}{r} = \tan\theta \Rightarrow AB = r\tan\theta$ ...(ii) $\frac{1}{2}$

$\frac{OB}{r} = \sec\theta \Rightarrow OB = r\sec\theta$ $\frac{1}{2}$

$PB = OB - r = r\sec\theta - r$ ...(iii) 1

Perimeter = $AB + PB + \overset{\frown}{AP}$

$= r\tan\theta + r\sec\theta - r + \frac{\pi r\theta}{180}$ 1

or $r\left[\tan\theta + \sec\theta - 1 + \frac{\pi\theta}{180}\right]$

27. Correct Given, To prove, Construction and Figure $4 \times \frac{1}{2} = 2$

Correct proof 2

28. Let the time taken by the taps to fill the tank be x minutes, x + 5 minutes resp.

$\therefore \quad \frac{1}{x} + \frac{1}{x+5} = \frac{9}{100}$ 2

$100(2x + 5) = 9x(x + 5)$

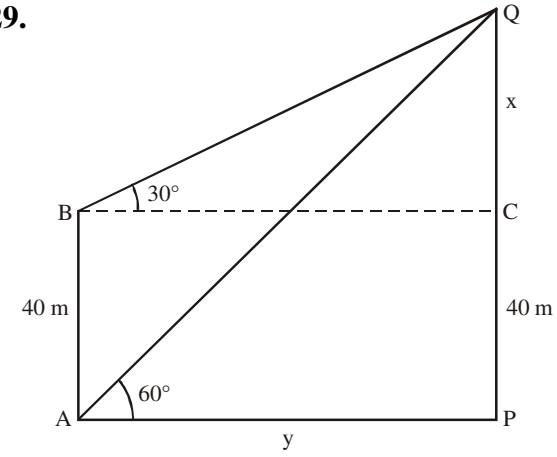
$\Rightarrow \quad 9x^2 - 155x - 500 = 0$

$(9x + 25)(x - 20) = 0$ 1

$\Rightarrow \quad x = 20$

$\therefore$ Times are 20 min and 25 min 1

29.



Correct Figure 1

$\frac{x + 40}{y} = \tan 60° = \sqrt{3}$

$x + 40 = \sqrt{3}y$ ...(i) 1

$\frac{x}{y} = \tan 30° = \frac{1}{\sqrt{3}}$

$\Rightarrow \quad \sqrt{3}\,x = y$ ...(ii) 1

$x + 40 = 3x \Rightarrow x = 20$ m

$y = 20\sqrt{3}$m

$\therefore$ Height of tower = 60 m

Horizontal distance = $20\sqrt{3}$m 1

30. Correct Construction 4

31. x can be any one of 1, 4, 9, 16

y can be any one of 1, 2, 3, 4

Total number of cases of xy = 16 $1\frac{1}{2}$

No. of cases where product more than 16

{18, 27, 36, 32, 48, 64} i.e. 6 $1\frac{1}{2}$

$\therefore$ Required Prob. = $\frac{6}{16}$ or $\frac{3}{8}$ 1