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Secondary School Certificate Examination

March 2019

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

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 30/2/1

EXPECTED ANSWER/VALUE POINTS

SECTION A

1. LCM (336, 54) = $\frac{336 \times 54}{6}$ $\frac{1}{2}$

= 336 × 9 = 3024 $\frac{1}{2}$

2. $\frac{3-a}{3a} - \frac{1}{a} = \frac{3-a-3}{3a} = -\frac{1}{3}$ 1

3. $2x^2 - 4x + 3 = 0 \Rightarrow D = 16 - 24 = -8$ $\frac{1}{2}$

∴ Equation has NO real roots $\frac{1}{2}$

4. $\sin^2 60° + 2\tan 45° - \cos^2 30 = \left(\frac{\sqrt{3}}{2}\right)^2 + 2(1) - \left(\frac{\sqrt{3}}{2}\right)^2$ [For any two correct values] $\frac{1}{2}$

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

OR

$\sin A = \frac{3}{4} \Rightarrow \cos A = \sqrt{1 - \frac{9}{16}} = \frac{\sqrt{7}}{4}$ $\frac{1}{2}$

$\sec A = \frac{4}{\sqrt{7}}$ $\frac{1}{2}$

5. Point on x-axis is (2, 0) 1

6. ΔABC: Isosceles Δ ⇒ AC = BC = 4 cm. $\frac{1}{2}$

$AB = \sqrt{4^2 + 4^2} = 4\sqrt{2}$ cm $\frac{1}{2}$

OR

$\frac{AD}{BD} = \frac{AE}{CE} \Rightarrow \frac{AD}{7.2} = \frac{1.8}{5.4}$ $\frac{1}{2}$

∴ $AD = \frac{7.2 \times 1.8}{5.4} = 2.4$ cm. $\frac{1}{2}$

SECTION B

7. Smallest number divisible by 306 and 657 = LCM (306, 657) 1

LCM (306, 657) = 22338 1

8. A, B, C are collinear $\Rightarrow$ ar. (ΔABC) = 0 $\frac{1}{2}$

$\therefore \quad \frac{1}{2}[x(6-3)-4(3-y)-2(y-6)] = 0$ 1

$\Rightarrow \quad 3x + 2y = 0$ $\frac{1}{2}$

OR

Area of triangle = $\frac{1}{2}[1(6+5)-4(-5+1)-3(-1-6)]$ 1

$= \frac{1}{2}[11+16+21] = \frac{48}{2} = 24$ sq. units. 1

9. P(blue marble) = $\frac{1}{5}$, P(black marble) = $\frac{1}{4}$

$\therefore \quad$ P(green marble) = $1-\left(\frac{1}{5}+\frac{1}{4}\right)=\frac{11}{20}$ 1

Let total number of marbles be x

then $\frac{11}{20}\times x = 11 \Rightarrow x = 20$ 1

10. For unique solution $\frac{1}{3} \neq \frac{2}{k}$ 1

$\Rightarrow \quad k \neq 6$ 1

11. Let larger angle be x°

$\therefore$ Smaller angle = 180° – x° $\frac{1}{2}$

$\therefore \quad (x) - (180 - x) = 18$ $\frac{1}{2}$

$2x = 180 + 18 = 198 \Rightarrow x = 99$ $\frac{1}{2}$

$\therefore$ The two angles are 99°, 81° $\frac{1}{2}$

OR

Let Son's present age be x years

Then Sumit's present age = 3x years. $\frac{1}{2}$

$\therefore$ 5 Years later, we have, $3x + 5 = \frac{5}{2}(x+5)$ $\frac{1}{2}$

$6x + 10 = 5x + 25 \Rightarrow x = 15$ $\frac{1}{2}$

$\therefore$ Sumit's present age = 45 years $\frac{1}{2}$

12. Maximum frequency = 50, class (modal) = 35 – 40. $\frac{1}{2}$

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

$$= 35 + \frac{50 - 34}{100 - 34 - 42} \times 5$$ 1

$$= 35 + \frac{16}{24} \times 5 = 38.33$$ $\frac{1}{2}$

SECTION C

13. Let $2 + 5\sqrt{3} = a$, where 'a' is a rational number. $\frac{1}{2}$

than $\sqrt{3} = \frac{a-2}{5}$ 1

Which is a contradiction as LHS is irrational and RHS is rational 1

$\therefore$ $2 + 5\sqrt{3}$ can not be rational $\frac{1}{2}$

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

Alternate method:

Let $2 + 5\sqrt{3}$ be rational $\frac{1}{2}$

$\therefore$ $2 + 5\sqrt{3} = \frac{p}{q}$, p, q are integers, $q \neq 0$

$\Rightarrow \sqrt{3} = \left(\frac{p}{q} - 2\right) \div 5 = \frac{p - 2q}{5q}$ 1

LHS is irrational and RHS is rational

which is a contradiction. 1

$\therefore 2 + 5\sqrt{3}$ is irrational. $\frac{1}{2}$

OR

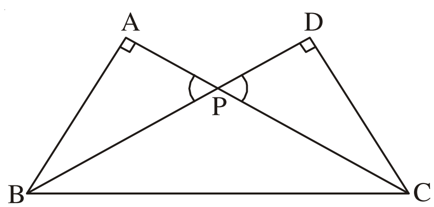
2048 = 960 × 2 + 128

960 = 128 × 7 + 64 2

128 = 64 × 2 + 0

$\therefore$ HCF (2048, 960) = 64 1

14.



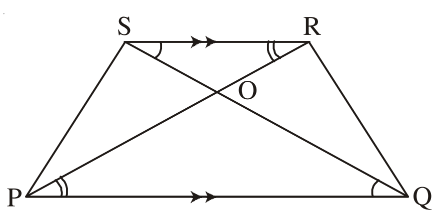
Correct Figure $\frac{1}{2}$

$\Delta APB \sim \Delta DPC$ [AA similarity] 1

$\frac{AP}{DP} = \frac{BP}{PC}$ 1

$\Rightarrow AP \times PC = BP \times DP$ $\frac{1}{2}$

OR



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

In ΔPOQ and ΔROS

$\left.\begin{array}{l}\angle P = \angle R \\ \angle Q = \angle S\end{array}\right\}$ alt. $\angle s$

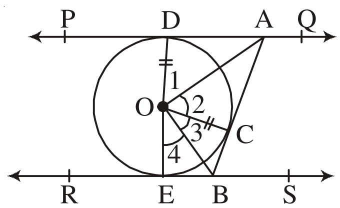
$\therefore \Delta POQ \sim \Delta ROS$ [AA similarity] 1

$\therefore \frac{ar(\Delta POQ)}{ar(\Delta ROS)} = \left(\frac{PQ}{RS}\right)^2$ 1

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

$\therefore ar(\Delta POQ) : ar(\Delta ROS) = 9 : 1$

15.



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

$\Delta AOD \cong AOC$ [SAS] 1

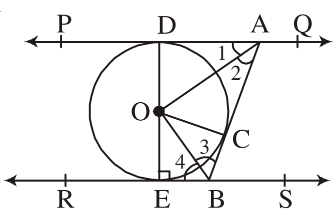
$\Rightarrow \angle 1 = \angle 2$ $\frac{1}{2}$

Similarly $\angle 4 = \angle 3$ $\frac{1}{2}$

$\Rightarrow \angle 1 + \angle 4 = \angle 2 + \angle 3 = \frac{1}{2}(180°)$

$\Rightarrow \angle 2 + \angle 3 = 90°$ or $\angle AOB = 90°$ $\frac{1}{2}$

Alternate method:



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

$\Delta OAD \cong \Delta AOC$ [SAS]

$\Rightarrow \angle 1 = \angle 2$ 1

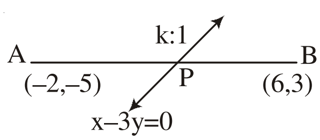
Similarly $\angle 4 = \angle 3$ $\frac{1}{2}$

But $\angle 1 + \angle 2 + \angle 3 + \angle 4 = 180°$ [$\because$ PQ ∥ RS]

$\Rightarrow \angle 2 + \angle 3 = \angle 1 + \angle 4 = \frac{1}{2}(180°) = 90°$ $\frac{1}{2}$

$\therefore$ In ΔAOB, $\angle AOB = 180° - (\angle 2 + \angle 3) = 90°$ $\frac{1}{2}$

16.



Let the line $x - 3y = 0$ intersect the segment

joining A(–2, –5) and B(6, 3) in the ratio k : 1 $\frac{1}{2}$

$\therefore$ Coordinates of P are $\left(\frac{6k-2}{k+1}, \frac{3k-5}{k+1}\right)$ 1

P lies on $x - 3y = 0 \Rightarrow \frac{6k-2}{k+1} = 3\left(\frac{3k-5}{k+1}\right) \Rightarrow k = \frac{13}{3}$

$\therefore$ Ratio is 13 : 3 1

$\Rightarrow$ Coordinates of P are $\left(\frac{9}{2}, \frac{3}{2}\right)$ $\frac{1}{2}$

17. $\left(\dfrac{3\sin 43^\circ}{\cos 47^\circ}\right)^2 - \dfrac{\cos 37^\circ \operatorname{cosec} 53^\circ}{\tan 5^\circ \tan 25^\circ \tan 45^\circ \tan 65^\circ \tan 85^\circ}$

$= \left(\dfrac{3\sin 43^\circ}{\cos(90^\circ - 43^\circ)}\right)^2 - \dfrac{\cos 37^\circ . \operatorname{cosec}(90^\circ - 37^\circ)}{\tan 5^\circ \tan 25^\circ (1) \tan(90^\circ - 25^\circ) \tan(90^\circ - 5^\circ)}$ 1

$= \left(\dfrac{3\sin 43^\circ}{\sin 43^\circ}\right)^2 - \dfrac{\cos 37^\circ . \sec 37^\circ}{\tan 5^\circ . \tan 25^\circ (1) \cot 25^\circ \cot 5^\circ}$ 1

$= 9 - \dfrac{1}{1} = 8$ 1

18. Radius of quadrant = $OB = \sqrt{15^2 + 15^2} = 15\sqrt{2}$ cm. 1

Shaded area = Area of quadrant – Area of square $\frac{1}{2}$

$= \dfrac{1}{4}(3.14)[(15\sqrt{2})^2 - (15)^2]$ 1

$= (15)^2 (1.57 - 1) = 128.25 \text{ cm}^2$ $\frac{1}{2}$

OR

$BD = \sqrt{(2\sqrt{2})^2 + (2\sqrt{2})^2} = \sqrt{16} = 4$ cm 1

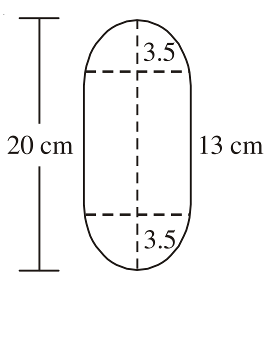
$\therefore$ Radius of circle = 2 cm $\frac{1}{2}$

$\therefore$ Shaded area = Area of circle – Area of square $\frac{1}{2}$

$= 3.14 \times 2^2 - (2\sqrt{2})^2$

$= 12.56 - 8 = 4.56 \text{ cm}^2$ 1

19.



Height of cylinder = 20 – 7 = 13 cm. 1

Total volume = $\pi\left(\dfrac{7}{2}\right)^2 \cdot 13 + \dfrac{4}{3}\pi\left(\dfrac{7}{2}\right)^3$ cm^3 1

$= \dfrac{22}{7} \times \dfrac{49}{4}\left(13 + \dfrac{4}{3}\cdot\dfrac{7}{2}\right)$cm^3

$= \dfrac{77 \times 53}{6} = 680.17 \text{ cm}^3$ 1

20.

x_i :	32.5	37.5	42.5	47.5	52.5	57.5	62.5		$\frac{1}{2}$
f_i :	14	16	28	23	18	8	3	$\Sigma f_i = 110$	$\frac{1}{2}$
u_i :	–3	–2	–1	0	1	2	3		
f_iu_i :	–42	–32	–28	0	18	16	9,	$\Sigma f_iu_i = -59$	1

Mean $= 47.5 - \frac{59 \times 5}{110} = 47.5 - 2.68 = 44.82$ 1

Note: If N is taken as 100, Ans. 44.55 Accept.

If some one write, data is wrong, give full 3 marks.

21.

$$3x^2 - 5 \overline{\big)\, 3x^4 - 9x^3 + x^2 + 15x + k \,\big(}\, x^2 - 3x + 2$$

$$\begin{array}{l} 3x^4 \quad - 5x^2 \\ - \qquad + \\ \hline -9x^3 + 6x^2 + 15x + k \\ -9x^3 \qquad + 15x \\ + \qquad\quad - \\ \hline 6x^2 + k \\ 6x^2 - 10 \\ - \quad + \\ \hline k + 10 \\ \hline \end{array}$$

2

$\therefore \quad k + 10 = 0 \Rightarrow k = -10$ 1

OR

$p(y) = 7y^2 - \frac{11}{3}y - \frac{2}{3} = \frac{1}{3}(21y^2 - 11y - 2)$

$= \frac{1}{3}[(7y + 1)(3y - 2)]$ 1

$\therefore \quad$ Zeroes are 2/3, –1/7 $\frac{1}{2}$

Sum of zeroes $= \frac{2}{3} - \frac{1}{7} = \frac{11}{21}$

$\frac{-b}{a} = \frac{11}{21} \quad \therefore$ sum of zeroes $= \frac{-b}{a}$ 1

Product of zeroes $= \left(\frac{2}{3}\right)\left(-\frac{1}{7}\right) = -\frac{2}{21}$

$\frac{c}{a} = -\frac{2}{3}\left(\frac{1}{7}\right) = -\frac{2}{21}$ ∴ Product = $\frac{c}{a}$ $\frac{1}{2}$

22. $x^2 + px + 16 = 0$ have equal roots if $D = p^2 - 4(16)(1) = 0$ 1

$p^2 = 64 \Rightarrow p = \pm 8$ $\frac{1}{2}$

∴ $x^2 \pm 8x + 16 = 0 \Rightarrow (x \pm 4)^2 = 0$ 1

$x \pm 4 = 0$

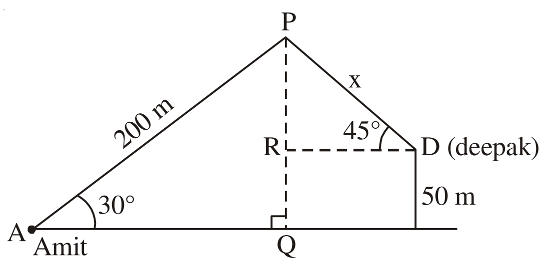
∴ Roots are $x = -4$ and $x = 4$ $\frac{1}{2}$

SECTION D

23. For correct, given, to prove, construction and figure $\frac{1}{2} \times 4 = 2$

For correct proof. 2

24.



Correct Figure 1

In ΔAPQ

$\frac{PQ}{AP} = \sin 30° = \frac{1}{2}$ $\frac{1}{2}$

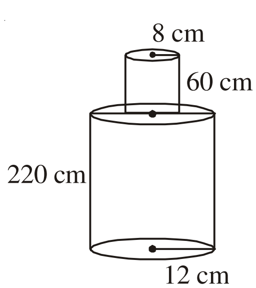
$PQ = (200)\left(\frac{1}{2}\right) = 100$ m 1

$PR = 100 - 50 = 50$ m $\frac{1}{2}$

In ΔPRD, $\frac{PR}{PD} = \sin 45° = \frac{1}{\sqrt{2}}$

$PD = (PR)(\sqrt{2}) = 50\sqrt{2}$ m 1

25.



Total volume = $3.14\,(12)^2\,(220) + 3.14(8)^2(60)$ cm^3 1

$= 99475.2 + 12057.6 = 111532.8$ cm^3 1

Mass = $\frac{111532.8 \times 8}{1000}$ kg 1

$= 892.262$ kg 1

26. Constructing an equilateral triangle of side 5 cm — 1

Constructing another similar Δ with scale factor $\frac{2}{3}$ — 3

OR

Constructing two concentric circle of radii 2 cm and 5 cm — 1

Drawing two tangents PA and PB — 2

PA = 4.5 cm (approx) — 1

27.

	Less than 40	less than 50	less than 60	less than 70	less than 80	less than 90	less than 100	$\frac{1}{2}$
cf.	7	12	20	30	36	42	50	1

Plotting of points (40, 7), (50, 12), (60, 20), (70, 30), (80, 36), (90, 42) and (100, 50) — $1\frac{1}{2}$

Joining the points to get the curve — 1

28. $\text{LHS} = \dfrac{\tan\theta}{1-\dfrac{1}{\tan\theta}} + \dfrac{\dfrac{1}{\tan\theta}}{1-\tan\theta} = \dfrac{\tan^2\theta}{\tan\theta-1} - \dfrac{1}{\tan\theta(\tan\theta-1)}$ — 1

$= \dfrac{\tan^3\theta-1}{\tan\theta(\tan\theta-1)} = \dfrac{(\tan\theta-1)(\tan^2\theta+\tan\theta+1)}{\tan\theta(\tan\theta-1)}$ — 1

$= \tan\theta+1+\cot\theta = 1+\dfrac{\sin\theta}{\cos\theta}+\dfrac{\cos\theta}{\sin\theta} = 1+\dfrac{\sin^2\theta+\cos^2\theta}{\sin\theta\cos\theta}$ — 1

$= 1+\dfrac{1}{\sin\theta\cos\theta} = 1+\text{cosec}\,\theta\sec\theta = \text{RHS}$ — 1

OR

Consider

$\dfrac{\sin\theta}{\text{cosec}\,\theta+\cot\theta} - \dfrac{\sin\theta}{\cot\theta-\text{cosec}\,\theta} = \dfrac{\sin\theta}{\text{cosec}\,\theta+\cot\theta} + \dfrac{\sin\theta}{\text{cosec}\,\theta-\cot\theta}$ — 1+1

$= \dfrac{\sin\theta[\text{cosec}\,\theta-\cot\theta+\text{cosec}\,\theta+\cot\theta]}{\text{cosec}^2\theta-\cot^2\theta} = \dfrac{\sin\theta(2\,\text{cosec}\,\theta)}{1} = 2$ — $1\frac{1}{2}$

Hence $\dfrac{\sin\theta}{\text{cosec}\,\theta+\cot\theta} = 2+\dfrac{\sin\theta}{\cot\theta-\text{cosec}\,\theta}$ — $\frac{1}{2}$

29. Let $-82 = a_n$ $\therefore$ $-82 = -7 + (n-1)(-5)$ — 1

$\Rightarrow$ $15 = n-1$ or $n = 16$ — 1

Again $-100 = a_m = -7 + (m-1)(-5)$ 1

$\Rightarrow \quad (m-1)(-5) = -93$

$m - 1 = \frac{93}{5}$ or $m = \frac{93}{5} + 1 \notin N$ 1

$\therefore \quad -100$ is not a term of the AP.

OR

$S_n = 180 = \frac{n}{2} \cdot [90 + (n-1)(-6)]$ 1

$360 = 90n - 6n^2 + 6n \Rightarrow 6n^2 - 96n + 360 = 0$ 1

$\Rightarrow \quad 6[(n-6)(n-10)] = 0 \Rightarrow n = 6, n = 10$ 1

Sum of $a_7, a_8, a_9, a_{10} = 0 \therefore n = 6$ or $n = 10$ 1

30. Let marks in Hindi be x

Then marks in Eng = $30 - x$ $\frac{1}{2}$

$\therefore \quad (x + 2)(30 - x - 3) = 210$ 1

$\Rightarrow \quad x^2 - 25x + 156 = 0$ or $(x - 13)(x - 12) = 0$ 1

$\Rightarrow \quad x = 13$ or $x = 12$

$\therefore \quad 30 - 13 = 17$ or $30 - 12 = 18$ 1

$\therefore$ Marks in Hindi & English are

(13, 17) or (12, 18) $\frac{1}{2}$