f/30/3

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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. $a + 6(-4) = 4$ ½

$\Rightarrow$ $a = 28$ ½

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

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

4. The required numbers are 2 and 4. ½

HCF of 2 and 4 is 2. ½

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

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

$\therefore$ $9 - 6k - 6 = 0$ ½

$\Rightarrow$ $k = \dfrac{1}{2}$ ½

SECTION B

7. Total number of possible outcomes = 36

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

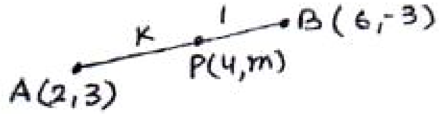
Total number of doublets = 6 ½

$\therefore$ 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

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

8. Let AP : PB = k : 1



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

$\Rightarrow$ 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

$\left.\begin{array}{ll}\Rightarrow & x + y = 30 \\ \text{and} & x - y = 14\end{array}\right\}$ — 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

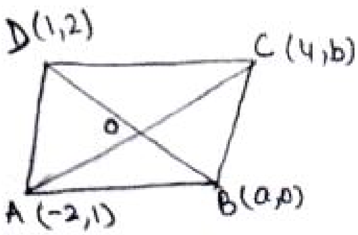
$\Rightarrow$ $\sqrt{2}$ is a rational number as RHS is rational — $\frac{1}{2}$

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

Hence $5+3\sqrt{2}$ is an irrational number. — $\frac{1}{2}$

SECTION C

13.



ABCD is a parallelogram

$\therefore$ diagonals AC and BD bisect each other

Therefore

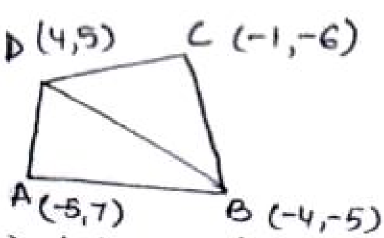
Mid point of BD is same as mid point of AC — $\frac{1}{2}$

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

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

$\Rightarrow$ $a = 1, b = 1$. Therefore length of sides are $\sqrt{10}$ units each. — $\frac{1}{2}+1$

OR



Area of quad ABCD = Ar ΔABD + Ar ΔBCD — $\frac{1}{2}$

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

$= 53$ sq units — 1

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

$= 19$ sq units — 1

Hence area of quad. ABCD = 53 + 19 = 72 sq units — $\frac{1}{2}$

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

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

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

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

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

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

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

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

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

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

$\therefore$ 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 $= 4 \times 9696 = 38784$

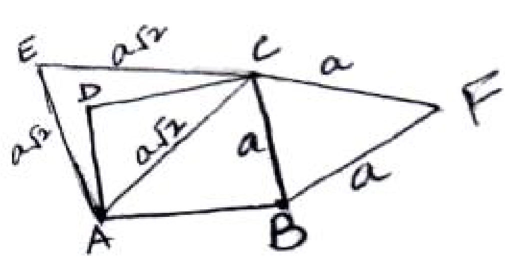
Also $404 \times 96 = 38784$

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

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

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 $\Delta BCF = \dfrac{\sqrt{3}}{4} a^2$ sq.u $\frac{1}{2}$

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

$\Rightarrow \quad$ Area $\Delta BCF = \dfrac{1}{2}$ Ar ΔACE $\frac{1}{2}$

OR

Let $\Delta ABC \sim \Delta PQR$.

$$\therefore \quad \frac{ar\ \Delta ABC}{ar\ \Delta PQR} = \frac{AB^2}{PQ^2} = \frac{BC^2}{QR^2} = \frac{AC^2}{PR^2} \qquad 1$$

Given ar ΔABC = ar ΔPQR

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

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

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

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

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

$\Rightarrow \quad x^2 + 100x - 300000 = 0$

$\Rightarrow \quad x^2 + 600x - 500x - 300000 = 0$

$\Rightarrow \quad (x + 600)(x - 500) = 0$ 1

$x \neq -600, \quad \therefore\ x = 500$ 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

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

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

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

$\therefore$ 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 = $(3.14) \times \frac{36}{4}$

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. $4 \tan\theta = 3$

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

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

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

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

OR

$\tan 2A = \cot(A - 18°)$

$\Rightarrow 90° - 2A = A - 18°$ 1

$\Rightarrow 3A = 108°$ 1

$\Rightarrow A = 36°$ 1

SECTION D

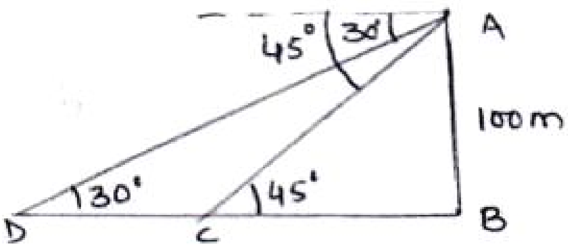
23. 

Figure 1

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

$$\tan 45° = \frac{AB}{BC}$$

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

$$\Rightarrow AB = BC$$ 1

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

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

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

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

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

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

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

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

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

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

$$= \tan A = \text{RHS}$$ 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	For x	$\frac{1}{2}$
23–25	24	4	96	Σf	$\frac{1}{2}$
		40 + f	704 + 20f	Σfx	1

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

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

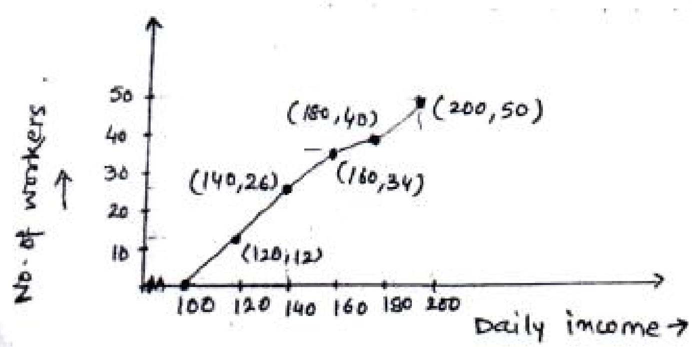
$\Rightarrow$ $f = 8$ 1

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

$1\frac{1}{2}$



$2\frac{1}{2}$

27. 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

$\Rightarrow$ $x^2 + 48x - 324 = 0$ ½

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

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

$\therefore$ 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

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

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

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

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

$\Rightarrow$ $4a = 32$

$\Rightarrow$ $a = 8$ 1

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

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

$\Rightarrow$ $d^2 = 4$ ½

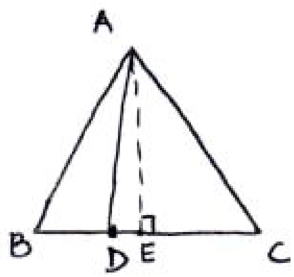
$\Rightarrow \quad d = \pm 2$ 1

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

29. Correct Construction of ΔABC 2

Correct construction of similar ~~to ΔABC~~. triangle. 2

30.



Draw $AE \perp BC$

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

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

Let $AB = BC = AC = x$

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

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

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

$$\left.\begin{aligned} &\text{Now} \quad AB^2 = AE^2 + BE^2 \quad &\text{...(1)} \\ &\text{and} \quad AD^2 = AE^2 + DE^2 \quad &\text{...(2)} \end{aligned}\right\}$$ 1

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

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

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

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

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

OR

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

Correct Proof 2