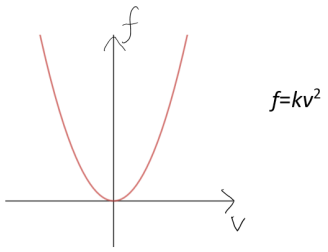
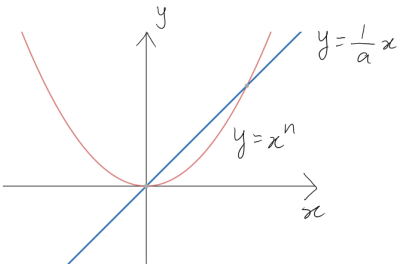
4048/01 Mathematics Paper 1

Preliminary Examination 2020 Mark Scheme

Qn	Solution	Marks	Total Marks
1	Smallest = 35 000 Largest = 44 999	B1 B1	2
2a	$x^2+9y^2-6xy-1$ $=(x-3y)^2-1$ $=(x-3y+1)(x-3y-1)$	 M1 A1	2
2b	$\frac{2}{3(x-4)^2}+\frac{1}{4-x}=\frac{2}{3(x-4)^2}-\frac{1}{x-4}$ $\frac{2}{3(x-4)^2}-\frac{1}{x-4}=\frac{2-3(x-4)}{3(x-4)^2}$ $=\frac{14-3x}{3(x-4)^2}$ **Alternative Method:** $\frac{2}{3(x-4)^2}+\frac{1}{4-x}=\frac{2}{3(4-x)^2}+\frac{1}{4-x}$ $\frac{2}{3(4-x)^2}+\frac{1}{4-x}=\frac{2+3(4-x)}{3(4-x)^2}$ $=\frac{14-3x}{3(4-x)^2}$	 M1 A1 M1 M1 A1	2
3a	$v=\frac{k}{t^3}$ $v_{new}=\frac{k}{(2t)^3}$ $=\frac{k}{8t^3}$ $=\frac{1}{8}v$ $=\frac{1}{8}\times 20$ $=2.5$	 M1 M1 A1	3

3b		B1	1
4a	$4\ \text{cm}^2 :\ 36\ \text{km}^2$ $1\ \text{cm}^2 :\ 9\ \text{km}^2$ $1\ \text{cm}\ \ :\ 3\ \text{km}$ $1 : 300\ 000$	 M1 A1	2
4b	$1 : 60\ 000$ $1\ \text{cm} : 0.6\ \text{km}$ $1\ \text{cm}^2 : 0.36\ \text{km}^2$ $36 \div 0.36 = 100\ \text{cm}^2$ **<u>Alternative Method:</u>** Let x be the area of the town on the second map. $x : 36 = 1 : 0.6^2$ $\frac{x}{36} = \frac{1}{0.36}$ $x = \frac{36}{0.36}$ $x = 100$	 M1 A1 M1(for squaring the values) A1	2
5a	When $9 - 5x < 2 - \frac{x}{4}$, $9 - 5x < \frac{8 - x}{4}$ $36 - 20x < 8 - x$ $-19x < -28$ $x > 1\frac{9}{19}$	 M1	3

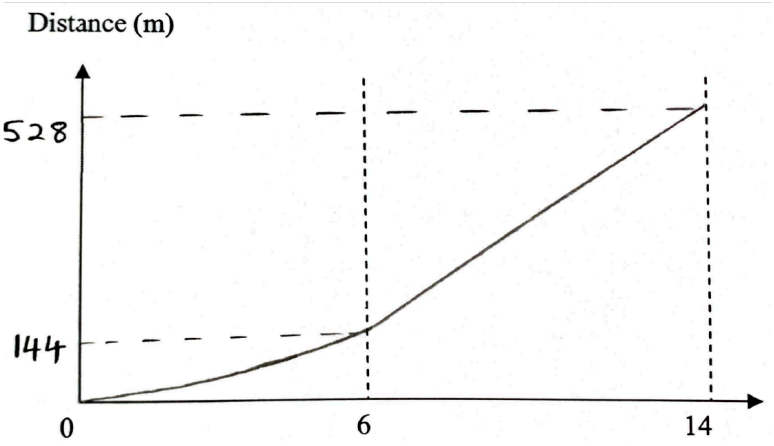
	When $2-\frac{x}{4} \le \frac{x}{3}-\frac{4x}{7}$, $\frac{8-x}{4} \le \frac{7x-12x}{21}$ $21(8-x) \le 4(-5x)$ $168-21x \le -20x$ $x \ge 168$ Hence, $x \ge 168$.	M1 A1	
5b	$\frac{3}{(2x-1)^2} = \frac{1}{3}$ $(2x-1)^2 = 9$ $2x-1=3$ or $2x-1=-3$ When $2x-1=3$, $2x=4$ $x=2$ When $2x-1=-3$, $2x=-2$ $x=-1$ Hence $x=2$ or $x=-1$.	M1 A1 (for both answers)	2
6a	$\left(\frac{x^6}{25y^4}\right)^{-\frac{1}{2}} = \left(\frac{25y^4}{x^6}\right)^{\frac{1}{2}}$ $= \frac{5y^2}{x^3}$ **<u>Alternative Method:</u>** $\left(\frac{x^6}{25y^4}\right)^{-\frac{1}{2}} = \frac{x^{-3}}{5^{-1}y^{-2}}$ $= \frac{5y^2}{x^3}$	M1 A1 M1 A1	2

6b	$9\sqrt[3]{3^{3x}} = \dfrac{1}{3^{3(2-x)}}$ $3^2 \times 3^x = \dfrac{1}{3^{6-3x}}$ $3^{2+x} = 3^{-6+3x}$ $2+x = -6+3x$ $-2x = -8$ $x = 4$	M1 M1 A1	3
6c	$x(ax^{n-1}-1) = 0$ $x = 0$ or $ax^{n-1}-1 = 0$ When $ax^{n-1}-1 = 0$, $ax^{n-1} = 1$ If n is even, $n-1$ is odd. Hence, $ax^{n-1} = 1$ will have 1 solution. There will be a total of 2 solutions for the given equation. **<u>Alternative Method:</u>** $ax^n = x$ $x^n = \dfrac{1}{a}x$ When n is even, we will have a curve and a straight line as seen below.  Hence, there will be 2 solutions for the given equation.	M1 M1 A1 M1, M1 (1 mark for each sketch) A1	3
7a	$x^2-2x+3 = x^2-2x+3+(-1)^2-(-1)^2$ $=(x-1)^2+2$	M1 A1	2
7b	Minimum value= 2	B1	1

7c	$x = 1$	B1	1
8a	$2\underline{\vert 13824}$ $2\underline{\vert 6912}$ $2\underline{\vert 3456}$ $2\underline{\vert 1728}$ $2\underline{\vert 864}$ $2\underline{\vert 432}$ $2\underline{\vert 216}$ $2\underline{\vert 108}$ $2\underline{\vert 54}$ $3\underline{\vert 27}$ $3\underline{\vert 9}$ $3\underline{\vert 3}$ 1 $13824 = 2^9 \times 3^3$	B1	1
8b	Since $13824 = (2^3 \times 3)^3$, 13824 can be written as a cube of another number.	B1	1
8c	$a = 2,$ $b = 3$	B1 B1	2

9	$4x - y = -4$ ---------- (1) $\frac{1}{3}y + x = \frac{5}{2}$ ---------- (2) From (2), $x = \frac{5}{2} - \frac{1}{3}y$ ---------- (3) Sub (3) into (1): $4\left(\frac{5}{2} - \frac{1}{3}y\right) - y = -4$ $10 - \frac{4}{3}y - y = -4$ $-\frac{7}{3}y = -14$ $y = 6$ Sub $y = 6$ into (2): $x = \frac{5}{2} - \frac{1}{3} \times 6$ $= \frac{1}{2}$ Hence, $x = \frac{1}{2}$ & $y = 6$.	M1 M1 A1	3
10a	gradient = $\frac{2-0}{-4-3}$ $= -\frac{2}{7}$ $y - 0 = -\frac{2}{7}(x-3)$ $y = -\frac{2}{7}x + \frac{6}{7}$ or $7y = -2x + 6$ **<u>Alternative Method:</u>** $\frac{y-0}{x-3} = \frac{2-0}{-4-3}$ $y = -\frac{2}{7}x + \frac{6}{7}$	M1 M1 A1 M1 A2	3

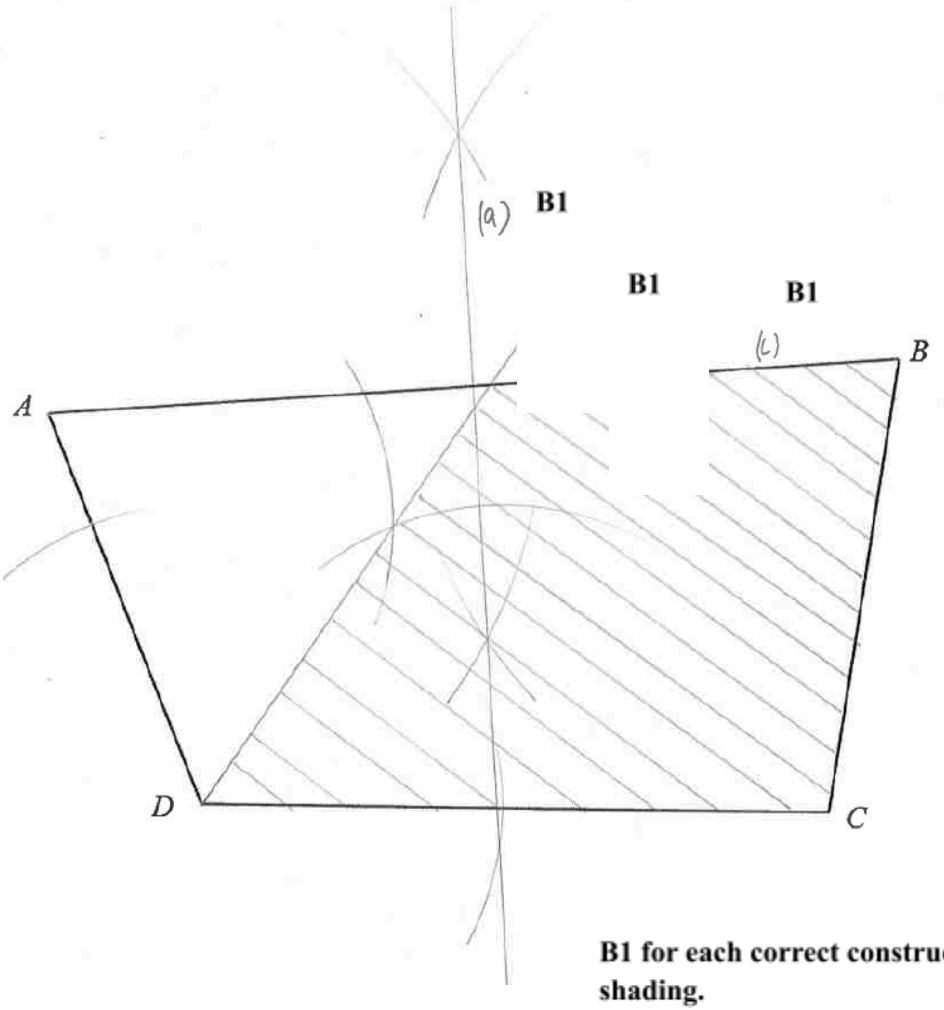
10b	length of $AB = \sqrt{(-4-3)^2+(2-0)^2}$ $= \sqrt{53}$ units $= 7.28$ units	M1 A1	2
10c	Since both the lines have a <u>different gradient</u>, they are not parallel. Hence, there will be <u>one point of intersection</u> between both the lines.	B2 (No marks for answers without reasoning)	2
11a	$T_n = n^2 - (2n+3)$ or $T_n = n^2 - 2n - 3$	B1	1
11b	$T_8 = 8^2 - (2\times 8+3)$ $= 64 - 19$ $= 45$	 B1	1
12	$\frac{l_1}{l_2} = \sqrt[3]{\frac{1}{8}}$ $= \frac{1}{2}$ $\frac{A_1}{A_2} = \left(\frac{1}{2}\right)^2$ $= \frac{1}{4}$ $\frac{y}{y+7} = \frac{1}{4}$ $4y = y+7$ $3y = 7$ $y = \frac{7}{3}$	 M1 M1 A1	3
13	Area of $\Delta SQR = 2\times$ Area of ΔPQS $\frac{\text{area of } \Delta SQR}{\text{area of } \Delta PQS} = \frac{1}{2}$ $\frac{\frac{1}{2}\times 12\times QS\times \sin SQR}{\frac{1}{2}\times 22\times QS\times \sin 42^\circ} = \frac{1}{2}$ $12\sin SQR = 11\sin 42^\circ$ $\angle SQR = 37.8^\circ$	 M1 M1 A1	3

14a	Let v be maximum speed. $720 = \frac{1}{2} \times 6 \times v + 8 \times v + \frac{1}{2} \times (8 \times v)$ $= 3v + 8v + 4v$ $15v = 720$ $v = 48$	M1 A1	2
14b	$\text{deceleration} = \frac{48 \text{ m/s}}{8 \text{ s}}$ $= 6 \text{ m/s}^2$	 B1	1
14c	Let x be speed of car at $t = 16$. $6 = \frac{48 - x}{2}$ $12 = 48 - x$ $x = 36$	M1 A1	2
14d		 B2 (award 1 mark if distance is not written and shape of graph is correct)	2
15a	$\angle QPC = \angle RPD$ (common $\angle$) $\angle RDP = 90^0$ (tan $\perp$ rad) $\angle QCP = 90^0$(tan $\perp$ rad) $\therefore \angle RDP = \angle QCP$ $PD = PC$ (tangents from an external point) Hence by ASA test, it is shown that ΔPQC is congruent to ΔPRD. **<u>Alternative Solution:</u>**	B1 B1 B1 B1	3

	$CQ = DR$(sum of radius of circle) $\angle PCQ = \angle PDR = 90^0$ (tan $\perp$ rad) $PD = PC$ (tangents from an external point) Hence by SAS test, it is shown that ΔPQC is congruent to ΔPRD.	B1 (for both) B1	
15b	$\angle OCR = \angle PDR = 90°$ (tan $\perp$ rad) $\angle ORC = \angle PRD$ (common $\angle$) Hence, by AA test, it is shown that ΔOCR is similar to ΔPDR.	B1 B1	2
16	Area of the shaded square representing mortality rate is not in proportion to the percentage quoted or the number of confirmed cases quoted. **Supporting reason (in terms of percentage):** The mortality rate for COVID-19 is 2% while the mortality rate for SARS is 10% but the area of the shaded square is smaller for SARS. **OR** The mortality rate for Ebola is 40% while the mortality rate for MERS is 34% yet, the area of the shaded square for MERS is so much smaller than that of the shaded square for Ebola. **Supporting reason (in terms of number of confirmed cases)**: The number of COVID-19 confirmed cases is 73,336 which is more than double the number of Ebola cases. However, the area of the unshaded square for the case of COVID-19 is not double the area of the unshaded square for the case of Ebola.	B2 (Any one of the supporting reason is sufficient) Award B1 if no exact data is quoted from the infograph.	2
17a	$(2\times 6.95\times 10^5)-(2\times 6\times 10^6 \div 10^3) = 1378000$ $= 1.378\times 10^6$ km	M1 (for calculation) A1 for answer in standard form	2
17bi	$(y-2)^3 - 4(y-2) = (y-2)[(y-2)^2 - 4]$ $= (y-2)(y-2-2)(y-2+2)$ $= y(y-2)(y-4)$	M1 A1	2
17bii	Since $y \geq 4$, minimum value of $y(y-2)(y-4)$ will be 0.	B1	1
18a	Median = 71	B1	1
18b	Lower quartile = 63.5 Upper quartile = 83 Interquartile range $= 83 - 63.5$ $= 19.5$	M1 A1	2
18c	Modal score = 68	B1	1
18d	Percentage distinction $= \frac{10}{25}\times 100\%$ $= 40\%$	B1	1

19a	Refer to diagram attached.
19b	Refer to diagram attached.
19c	Refer to diagram attached.

19 The diagram below shows a plot of farming land *ABCD*.



B1 for each correct construction / shading.