General Certificate of Education Ordinary Level 2019
Mathematics 4048/02
Syllabus 4048 Paper 2
SUGGESTED Solutions & Marking Scheme Mark Allocation
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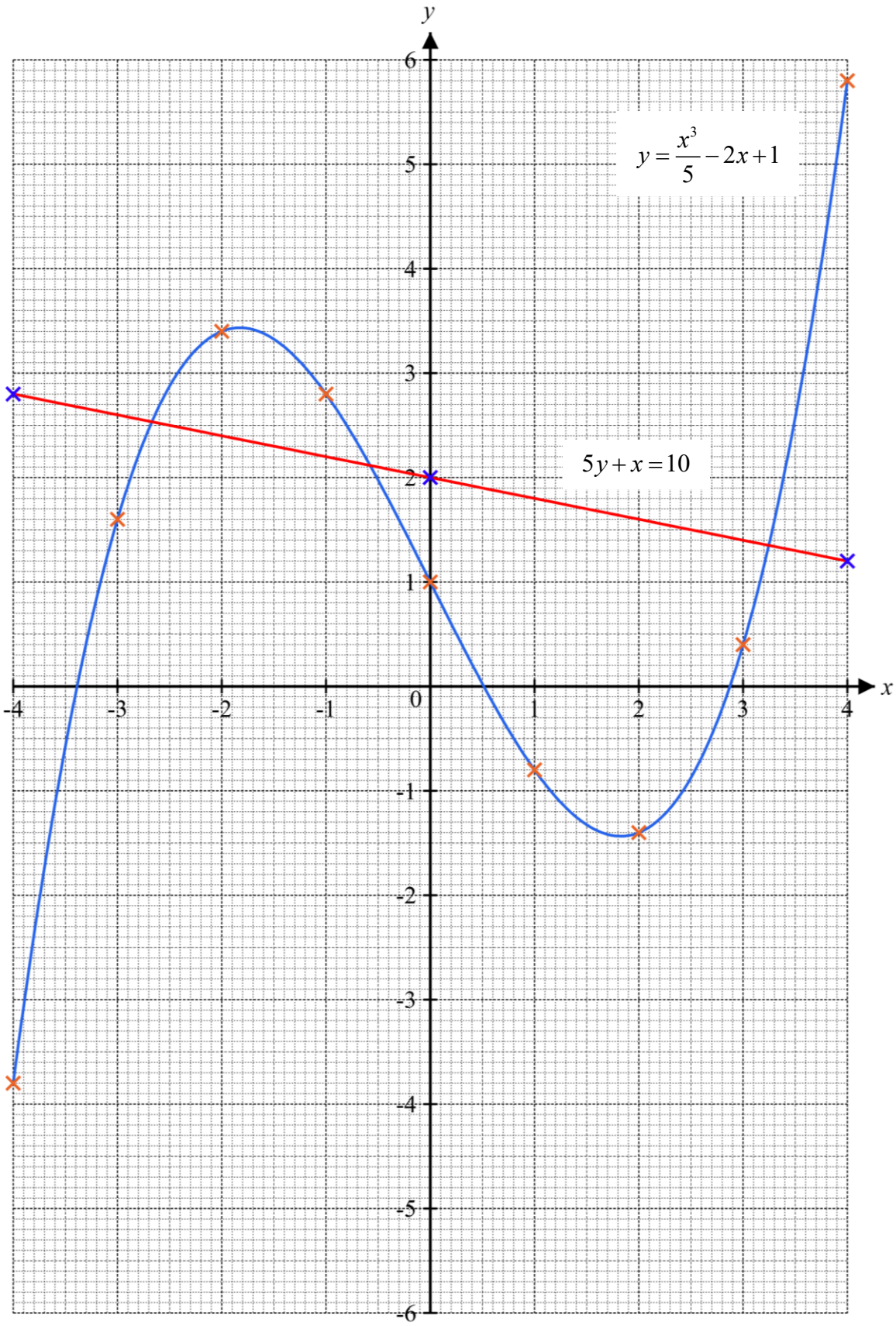
1	(a)	$\frac{2p^3}{3r^2}$	B1		
	(bi)	$a=-10$	B1		
	(bii)	$5a-ab=3b+4c$ $3b+ab=5a-4c$	M1	Rearrange terms	
		$b(3+a)=5a-4c$ $b=\frac{5a-4c}{3+a}$	A1		
	(ci)	$\left(x-\frac{7}{2}\right)^2-\left(\frac{7}{2}\right)^2+9$	M1	Complete the square correctly	
		$=\left(x-\frac{7}{2}\right)^2-\frac{13}{4}$ $=-\frac{13}{4}+\left(-\frac{7}{2}+x\right)^2$	A1	In required form, accept in decimal form or mixed number o.e.	
	(cii)	$\left(\frac{7}{2},-\frac{13}{4}\right)$	B1	o.e.	
	(d)	$\frac{x-1+6(x-3)}{(x-3)(x-1)}=2$	M1	Join fraction	
		$x-1+6x-18=2\left(x^2-3x-x+3\right)$	M1	Expand	
		$2x^2-8x+6=7x-19$ $2x^2-15x+25=0$ $(2x-5)(x-5)=0$	M1	Factorise o.e.	
		$x=\frac{5}{2}$ or $x=5$	A1	Both values o.e.	
					[11]

2	(a)	Using cosine rule, $CX = \sqrt{6.4^2 + 8.3^2 - 2(6.4)(8.3)\cos 27°}$	M2	Deduct M1 for any wrong substitution	
		$= 3.897366658 \text{ cm} = 3.90 \text{ cm (3 s.f.)}$	A1		
	(b)	Using sine rule, $\frac{\sin \angle XAB}{6.4} = \frac{\sin 112°}{7.5}$	M1		
		$\angle XAB = \sin^{-1}\left(\frac{6.4\sin 112°}{7.5}\right)$ $= 52.29750374° = 52.3° \text{ (1 d.p.)}$	A1		
	(c)	Angle ABC $= 180° - 112° - 52.29750374° + 27° = 42.70249626°$	M1		
		Area of triangle $ABC = \frac{1}{2}(7.5)(8.3)\sin 42.70249626°$	M1		
		$= 21.10871629 \text{ cm}^2 = 21.1 \text{ cm}^2 \text{ (3 s.f.)}$	A1		
					[8]

3	(a)	Price of phone in UK $= \$\dfrac{389}{0.58} = \$670.6896552$	M1		
		Difference $= \$670.6896552 - \$620$ $= \$50.6896552 = \$50.69$ (2 d.p.)	A1		
	(b)	Price before sale $= \dfrac{100}{94} \times \$785$	M1		
		$= \$835.106383 = \$835$ (nearest dollar)	A1		
	(ci)	9.2×10^5	B1		
	(cii)	Percentage increase $= \dfrac{1.20 \times 10^7 - 7.85 \times 10^6}{7.85 \times 10^6} \times 100\%$	M1		
		$= 52.86624204\% = 52.9\%$ (3 s.f.)	A1		
	(ciii)	Mean SMS per person per day in 2015 $= \dfrac{1.14 \times 10^{10}}{5.54 \times 10^6} \div 365$	M2	M1 for per person M1 for per day	
		$= 5.637703378 = 5.64$ (3 s.f.)	A1		
					[10]

4	(a)	$p = -\frac{19}{5}$	B1	o.e.	
	(b)	Refer to graph on page 5			
		Plotting of any 6 correct points	P1		
		Plotting of all 9 points correctly	P1		
		Smooth curve passing through all points	C1		
	(c)	$x > 3.75$	B1	Accept ± 0.1	
	(di)	Refer to graph on page 5			
		Plotting of any 3 relevant points within $-4 \le x \le 4$	P1		
		Straight line passing through all points plotted for range	L1		
	(dii)	$5\left(\frac{x^3}{5} - x + 1\right) + x = 10$	M1	Substitution s.o.i.	
		$x^3 - 10x + 5 + x = 10$ $x^3 - 9x - 5 = 0$ (Shown)	A1 AG		
	(diii)	$x = -2.65$ or -0.55 or 3.25	B2	B1 for any two correct B1 for all correct Accept ± 0.1	
					[11]

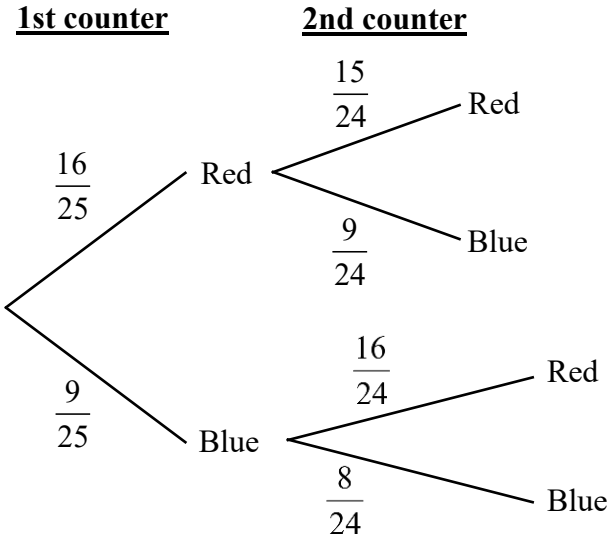

y
x
$y = \frac{x^3}{5} - 2x + 1$
$5y + x = 10$
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-4
-3
-2
-1
1
2
3
4

5	(ai)	t^2+18t	B1	c.a.o.	
	(aii)	Product of middle two numbers $=(t+6)(t+12)$ $=t^2+6t+12t+72=t^2+18t+72$	M1		
		Difference $=t^2+18t+72-\left(t^2+18t\right)=72$ (Shown)	A1 AG		
	(aiii)	$t+t+6+t+12+t+18=360$	M1	Form equation	
		$4t=324$ $t=81$	M1		
		Largest number $=81+18=99$	A1		
	(bi)	$8n+12$	B2	B1 for each term	
	(bii)	$8n+12=4(2n+3)$ Since 4 is a factor of the nth term, the terms of the sequence are all multiples of 4.	B1 AG		
					[9]

6	(ai)	Angle $ABC = 90°$ (right-angle in semicircle)	B1	Must give reason	
		Angle $CBD =$ Angle $OAD = 23°$ (angles in same segment)	M1	Must give reason	
		Angle $ABD = 90° - 23° = 67°$	A1		
		Alternatively:			
		Angle $AOD = 180° - 2(23°) = 134°$ (base angles of an isosceles triangle, angles sum of triangle)	M2	M1 for each reason	
		Angle $ABD = 134° \div 2 = 67°$ (angle at centre is twice the angle at circumference)	A1	Must give reason	
	(aii)	Angle $AED = 180° - 67° = 113°$ (angles in opposite segments)	M1	Must give reason	
		Angle $EAD = 180° - 113° - 42°$ (angles sum of triangle)	M1	Must give reason	
		$= 25°$	A1		
	(bi)	Minor arc length $PQ = 15.2 - 2(4) = 7.2$ cm	M1		
		Angle $POQ = \frac{7.2}{4} = 1.8$ radians	A1		
	(bii)	Area of minor sector $PQO = \frac{1}{2}(4)^2(1.8) = 14.4$ cm^2	M1		
		Area of major sector $PQO = \pi(4)^2 - 14.4 = 16\pi - 14.4$ Area of major sector $RSO = \frac{1}{2}(6)^2(2\pi - 1.8) = 36\pi - 32.4$	M1	Either one seen	
		Total shaded area $= 14.4 + 36\pi - 32.4 - 16\pi + 14.4$ $= 59.23185307$ cm^2 $= 59.2$ cm^2 (3 s.f.)	A1		
					[11]

7	(ai)	$\overrightarrow{PQ} = \begin{pmatrix} -9 \\ 4 \end{pmatrix}$	B1		
	(aii)	$\overrightarrow{PR} = \begin{pmatrix} h \\ 3 \end{pmatrix} - \begin{pmatrix} 4 \\ -3 \end{pmatrix} = \begin{pmatrix} h-4 \\ 6 \end{pmatrix}$	M1	s.o.i. or M0	
		$4k = 6 \Rightarrow k = 1.5$	A1	or B1 for each value	
		$h - 4 = -9(1.5) \Rightarrow h = -9.5$			
	(bi)	$\overrightarrow{AC} = \frac{5}{2}\mathbf{b} - \mathbf{a}$	B2	B1 for each term o.e.	
	(bii)	$\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$	M1		
		$\overrightarrow{XB} = \frac{2}{3}(\mathbf{b} - \mathbf{a})$	A1	o.e.	
	(biii)	$\frac{\overrightarrow{XY}}{\overrightarrow{AC}} = \frac{2}{3} \Rightarrow \overrightarrow{XY} = \frac{2}{3}\overrightarrow{AC}$	M1	Using similar triangles s.o.i.	
		$\overrightarrow{XY} = \frac{2}{3}\left(\frac{5}{2}\mathbf{b} - \mathbf{a}\right) = \frac{5}{3}\mathbf{b} - \frac{2}{3}\mathbf{a}$	A1	o.e.	
					[9]

8	(a)	Volume $= \frac{1}{2}(4+5)(6)(25) + \frac{1}{2}(4+6.5)(10)(25)$	M2	M1 for area of trapezium M1 for volume	
		$= 1987.5 \text{ m}^3$	A1	c.a.o.	
	(b)	By Pythagoras' Theorem, $FE = \sqrt{10^2 + 2.5^2} = \sqrt{106.25}$ $AG = \sqrt{1^2 + 6^2} = \sqrt{37}$	M1 M1	M1 for attempt to use Pythagoras' Theorem M1 for either FE or AG found	
		Total area $= 25\left(\sqrt{37} + \sqrt{106.25}\right)$	M1	Area of rectangle	
		$= 409.7631649 \text{ m}^2 = 410 \text{ m}^2$ (3 s.f.)	A1		
	(c)	Let X be the point vertically below P on the rectangular base.			
		By Pythagoras' Theorem, $DX = \sqrt{10^2 + 25^2} = \sqrt{725}$	M2	M1 for attempt to use Pythagoras' Theorem M1 for DX	
		Let the angle of elevation be θ.			
		$\tan\theta = \frac{6.5}{\sqrt{725}}$	M1	Attempt to use trigo ratio	
		$\theta = \tan^{-1}\left(\frac{6.5}{\sqrt{725}}\right)$ $= 13.57176784° = 13.6°$ (1 d.p.)	A1		
					[11]

9	(ai)	Median $= 71.5$	B1		
	(aii)	Range $= 43$	B1		
	(aiii)	Percentage $= 58\frac{1}{3}\%$ or 58.3% (3 s.f.)	B1	o.e.	
	(aiv)	There is a higher percentage / proportion of students who were awarded a merit in group B of 65%, than group A.	B1	If percentages or figures are not quoted in either / both answers, deduct B1.	
		There is a higher percentage / proportion of students who were awarded a distinction in group A of $20\frac{5}{6}\%$ (or 20.8% to 3 s.f.), than group B of 20%.	B1		
	(bi)	He calculated the probability with <u>replacement</u>. His calculation was $\frac{9}{25}\times\frac{9}{25}=\frac{81}{625}$ but instead should be $\frac{9}{25}\times\frac{8}{24}=\frac{3}{25}$, without replacement.	B1	'Replacement' o.e. **must** be mentioned in answer or B0. Working alone is **not** sufficient.	
	(bii)		B2	B1 for correct probabilities B1 for tree diagram with correct events Deduct B1 if 'B' or 'R' are used in diagram without a labelled legend	
	(biii)	$\frac{16}{25}\times\frac{9}{24}\times 2$	M1	One case s.o.i.	
		$=\frac{12}{25}$	A1	o.e.	
					[10]

10	(a)	Fuel used $= \frac{92}{100} \times 6.3 = 5.796$ litres ≈ 5.8 litres (Shown)	B1 AG		
	(b)	Distance travelled $= \frac{45}{60} \times 85 = 63.75$ km	M1		
		Fuel used $= \frac{63.75}{100} \times 4.2 = 2.6775$ litres	A1	c.a.o.	
	(c)	Let the distance travelled in the first stage be x km.			
		$\frac{x}{60} + \frac{x-25}{75} = 3\frac{15}{60}$	M1	Form equation o.e.	
		$\frac{75x + 60x - 1500}{4500} = \frac{13}{4}$	M1	Join fraction	
		$135x - 1500 = 14625$ $135x = 16125$ $x = 119\frac{4}{9}$	M1	Find distance travelled in first stage o.e.	
		Total distance travelled $= 2\left(119\frac{4}{9}\right) - 25 = 213\frac{8}{9}$ km	M1		
		Fuel used $= \frac{213\frac{8}{9}}{100} \times 5 = 10\frac{25}{36}$ litres	M1	o.e.	
		Total cost $= 10\frac{25}{36}(\$2.07) \times 95\% = \$21\frac{49}{1600}$	M1	95% s.o.i.	
		Hamid's portion to pay $= \$21\frac{49}{1600} \div 2 = \$10.5153125$ A suitable amount for Hamid to pay is \$10.55 as it is a convenient amount and is not less than half the total cost.	A1 AG	Must provide an explanation to justify the amount Hamid has to pay, or A0.	
		<u>Acceptable reasons/justifications to Hamid's amount:</u> You are allowed to modify the amount / proportion Hamid must pay Leila if it satisfies all the following criteria(s): • Hamid pays at least half of the total cost (must be rounded up) • Costs are calculated **<u>in favour</u>** of Leila (e.g. Hamid pays 60% of the total as Leila is driving the car, etc.) • The final amount can be paid in cash/coins (i.e. costs like \$10.51 or \$10.53 are not accepted, **<u>unless</u>** it is stated that Hamid pays using a cashless method e.g. bank transfer or PayNow)			
					[10]

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