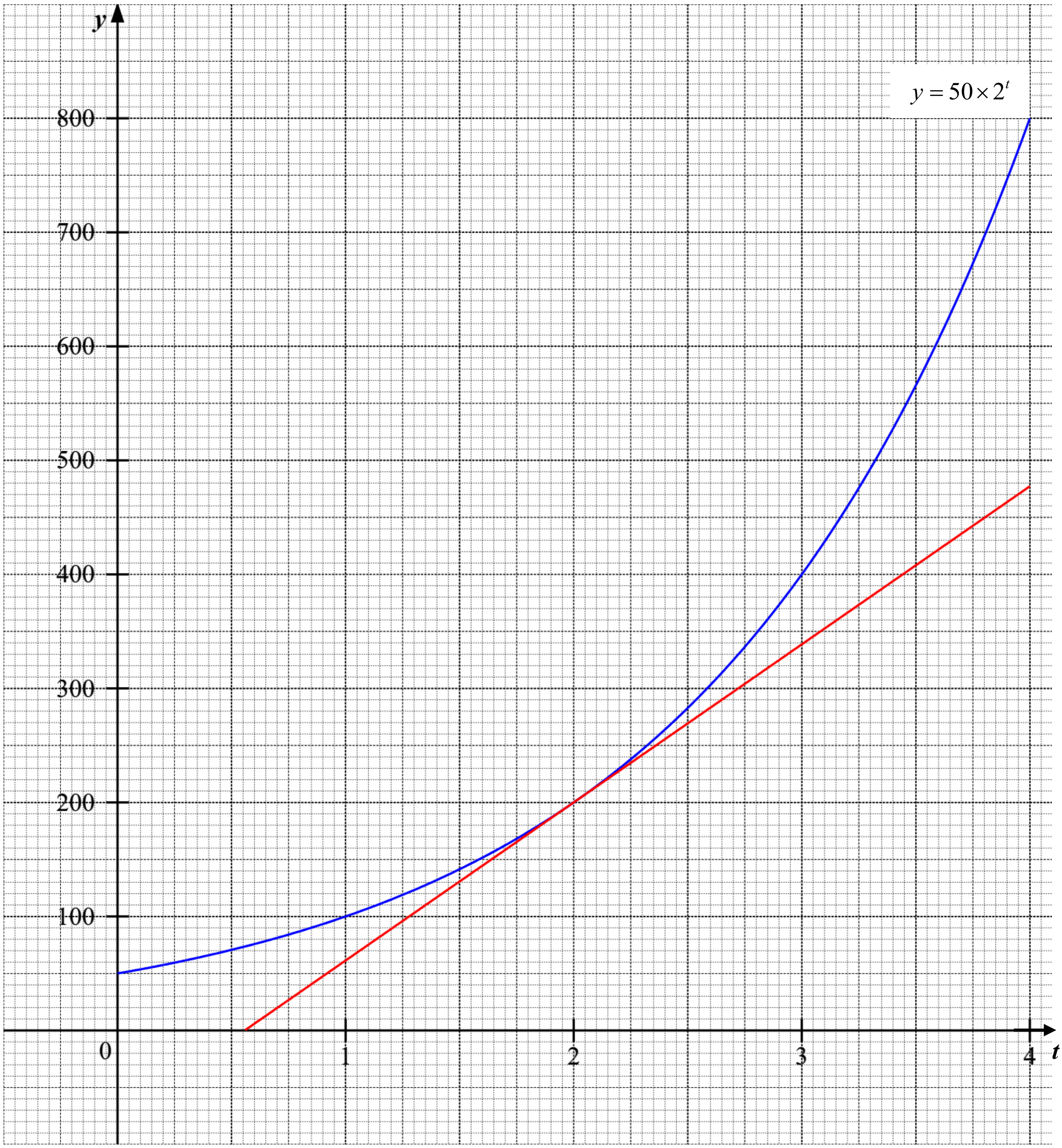
General Certificate of Education Ordinary Level 2017
Mathematics 4048/02
Syllabus 4048 Paper 2
SUGGESTED Solutions & Marking Scheme Mark Allocation
Prepared by: Jordan Tew (*@math_stuff_here*)

1	(a)	$\frac{x+4}{5} \geq \frac{2-x}{3}$ $3x+12 \geq 10-5x$	M1	Remove fraction	
		$8x \geq -2$ $x \geq -\frac{1}{4}$	A1	o.e.	
	(b)	$\frac{2y(5-2y)-3y}{(5-2y)^2}$	M1	Join fraction	
		$=\frac{10y-4y^2-3y}{(5-2y)^2}$ $=\frac{7y-4y^2}{(5-2y)^2}$	A1		
	(c)	$\frac{18h^3j^3}{5k^3} \times \frac{10j^2}{3h^5k}$	M1	Flip fraction or M0	
		$=\frac{12j^5}{h^2k^4}$	A1	or B1 for 12 or B1 for $\frac{j^5}{h^2k^4}$	
	(d)	$\left(\frac{v^{12}}{16t^8}\right)^{\frac{1}{4}}$	M1	Flip fraction or M0	
		$=\frac{v^3}{2t^2}$	A1	or B1 for $\frac{1}{2}$ o.e. or B1 for $\frac{v^3}{t^2}$	
	(e)	$\frac{2(x+4)+3(x-2)}{(x-2)(x+4)}=1$ $2x+8+3x-6=x^2-2x+4x-8$	M1	Remove fraction	
		$x^2-3x-10=0$ $(x+2)(x-5)=0$	M1	Factorise o.e.	
		$x=-2$ or $x=5$	A1	A1 for both	
					[11]

2	(ai)	Mean $= \dfrac{5.41\times10^{7}}{12}$	M1		
		$= 4.5083333\times10^{6} = 4.51\times10^{6}$ (3 s.f.)			
		4.51 million	A1		
	(aii)	Percentage $= \dfrac{5.09\times10^{6}}{5.41\times10^{7}}\times100\%$	M1		
		$= 9.408502773\% = 9.41\%$ (3 s.f.)	A1		
	(b)	Number of people $= 1.591\times10^{6}\times101.6\%$	M1	o.e.	
		$= 1.616456\times10^{6}$	A1	c.a.o.	
	(c)	Number of visitors $= \dfrac{100}{97}\times1.509\times10^{7}$	M1		
		$= 1.555670103\times10^{7} = 1.56\times10^{7}$ (3 s.f.)	A1	o.e.	
					[8]
3	(a)	50 bacteria	B1		
	(b)	$p = 70.7$ (3 s.f.)	B1	c.a.o.	
	(c)	Refer to graph on page 3			
		Correct scale used to draw graph	S1		
		Plotting of all 8 points correctly	P1		
		Smooth curve passing through all points	C1		
	(d)	3.325 hours	B1	Accept $\pm$ 0.05	
	(ei)	Drawing of reasonable tangent at (2, 200)	M1		
		Gradient $= \dfrac{450-20}{3.8-0.7} = 138.7096774 = 139$ (3 s.f.)	A1	Accept $\pm$ 5	
	(eii)	It represents the <u>rate of growth</u> of bacteria on the 2nd hour to be <u>139 bacteria per hour</u>.	B1	FT from (e)(i)	
					[9]


y
800
700
600
500
400
300
200
100
0
1
2
3
4
t
$y = 50 \times 2^t$

4	(a)	$AB=\sqrt{(-4-4)^2+\left(10-(-2)\right)^2}$	M1		
		$=14.4222051=14.4$ units (3 s.f.)	A1		
	(b)	Gradient $=\dfrac{10-(-2)}{-4-4}=-\dfrac{3}{2}$	M1		
		$y=-\dfrac{3}{2}x+c$ $10=-\dfrac{3}{2}(-4)+c\Rightarrow c=4$			
		$y=-\dfrac{3}{2}x+4$	A1	o.e.	
	(ci)	$3x+2y=5$ $2y=-3x+5$ $y=-\dfrac{3}{2}x+\dfrac{5}{2}\quad ---(1)$	M1	Express in the form $y=mx+c$ or find gradient	
		Since the <u>gradients</u> of line p and AB <u>are equal</u> and they have <u>distinct y-intercepts</u>, both lines are <u>parallel</u> and won't intersect.	A1	Conclusion	
	(cii)	$6y=4x-37\quad ---(2)$			
		Substitute (1) into (2) $6\left(-\dfrac{3}{2}x+\dfrac{5}{2}\right)=4x-37$	M1	Substitution or elimination s.o.i.	
		$-9x+15=4x-37$ $13x=52$ $x=4,\ y=-\dfrac{7}{2}$	A1		
		$\left(4,-\dfrac{7}{2}\right)$	A1	o.e.	
					[9]

5	(a)	Angle $ACB = 122° - 64° = 58°$	M1	s.o.i.	
		Using cosine rule, $AB = \sqrt{104^2 + 135^2 - 2(104)(135)\cos 58°}$	M1		
		$= 118.9994414 = 119$ m (3 s.f.)	A1		
	(b)	Using sine rule, $\frac{\sin \angle ABC}{135} = \frac{\sin 58°}{118.9994414}$	M1	Use of sine rule	
		$\angle ABC = 47.82987621°$			
		Bearing $= 360° - (180° - 122°) + 47.82987621°$	M1	$180° - 122°$ s.o.i.	
		$= 349.8298762° = 349.8°$ (1 d.p.)	A1		
	(c)	$\sin 58° = \frac{TA}{104}$ $TA = 104 \sin 58°$	M1		
		$= 88.197002 = 88.2$ m (3 s.f.)	A1		
	(d)	$\tan 27° = \frac{CD}{135}$ $CD = 135 \tan 27°$	M1		
		$= 68.78593568 = 68.8$ m (3 s.f.)	A1		
					[10]

6	(a)	$\overrightarrow{RC} = 2\mathbf{p} + \mathbf{q}$	B2	B1 for each term	
	(bi)	Since $\overrightarrow{RC} = 2\overrightarrow{ST}$, then RC and ST are parallel.	B1	Must state	
		Angle RDC = Angle SDT (Common angle) Angle DRC = Angle DST (Corresponding Angles, RT is parallel to ST) Angle DCR = Angle DTS (Corresponding Angles, RT is parallel to ST)	M1	Any two reasons given	
		Triangles RCD and STD are similar. (AA Similarity Test)	A1	Must state AA	
	(bii)	Let h denote the height of the parallogram			
		Area of triangle STD : area of parallelogram $ABCD$ $= \frac{1}{2}(1)\left(\frac{1}{2}h\right) : 2 \times \frac{1}{2}(6)(h)$	M1		
		$= 1:24$	A1		
	(biii)	$\overrightarrow{QA} = -2\mathbf{p} - \mathbf{q}$	M1	or M0	
		$\overrightarrow{QR} = -2\mathbf{p} - \mathbf{q} + 2\mathbf{q} = -2\mathbf{p} + \mathbf{q}$	A1	or B1 per term	
					[9]

7	(a)	Height $=(x-5)$ cm	B1		
		Width $=2(x-5)=(2x-10)$ cm	B1	FT from height	
	(b)	$x(2x-10)+(x-5)\big(2(2x-10)+2x\big)=48$	M1	Form equation	
		$2x^2-10x+(x-5)(4x-20+2x)=48$ $2x^2-10x+(x-5)(6x-20)=48$ $2x^2-10x+6x^2-30x-20x+100=48$	M1	Expand s.o.i.	
		$8x^2-60x+52=0$ $4\left(2x^2-15x+13\right)=0$ $2x^2-15x+13=0$ (Shown)	A1 AG		
	(c)	$(2x-13)(x-1)=0$	M1	Factorise o.e.	
		$x=\dfrac{13}{2}$ or $x=1$	A2	A1 for each value	
	(d)	$x=1$ is rejected as the height of the cuboid is negative.	B1	o.e.	
	(e)	Volume $=6.5(6.5-5)\big(2(6.5)-10\big)$	M1		
		$=29.25$ cm^3	A1	c.a.o.	
					[11]

8	(a)	$\cos\angle AOM = \frac{20}{30}$ $\angle AOM = \cos^{-1}\left(\frac{2}{3}\right)$	M1		
		Angle $AOB = 2\angle AOM$ $= 2\cos^{-1}\left(\frac{2}{3}\right)$ $= 96.37937021° = 96.4°$ (3 s.f.)	A1 AG		
	(b)	Shaded area $= \frac{96.37937021°}{360°}\times\pi(30)^2 - \frac{1}{2}(30)^2\sin 96.37937021°$	M3	M1 for sector M1 for triangle M1 for difference	
		$= 309.748208 = 310$ cm^2 (3 s.f.)	A1		
	(ci)	Volume of water $= 309.748208\times 150$	M1	FT from (b)	
		$= 46462.2312 = 46500$ cm^3 (3 s.f.)	A1		
	(cii)	Volume of water needed $= \frac{\pi(30)^2}{2}\times 150 - 46462.2312$	M1	FT from (c)(i)	
		$= 165595.2729$ cm^3	A1		
		$= 165.5952729 = 170$ litres (nearest 10 litres)	A1		
					[11]

9	(ai) (a)	42 km/h	B1		
	(ai) (b)	Lower quartile $=37$ Upper quartile $=46$	M1	Either one seen	
		IQR $=46-37=9\,\text{km/h}$	A1		
	(aii)	Number of people who exceed speed limit $=80-73=7$	M1	s.o.i.	
		Percentage $=\dfrac{7}{80}\times 100\%=8.75\%$	A1		
	(aiii)	On average, the cars passing the checkpoint in the morning drove at a faster speed than those in the afternoon as the median speed of 42 km/h is higher than 40 km/h in the afternoon.	B1	Must state figures	
		The cars passing the checkpoint in the afternoon drove at a more consistent speed than those in the morning as the interquartile range of 8 km/h is lower than 9 km/h of those in the morning.	B1	Must state figures	
	(bi)	$\dfrac{17}{40}$	B1		
	(bii) (a)	$\dfrac{5}{80}\times\dfrac{4}{79}$	M1		
		$=\dfrac{1}{316}$	A1		
	(bii) (b)	$\dfrac{16}{80}\times\dfrac{51}{79}\times 2$	M1	One case s.o.i.	
		$=\dfrac{102}{395}$	A1		
					[12]

10	(a)	Estimated length of route $= 27.7\text{ cm}$	M1	Accept ± 0.6	
		Length of route in km $= 5.54\text{ km}$	A1	Accept ± 0.12	
	(b)	Time taken to walk $= \dfrac{5.54}{6.5} \times 60 \times 3 = 153.41538...$ mins	M1	Find time taken for one brisk walk	
		Since she takes a total of more than 150 minutes of moderate-intensity aerobic activity per week, she meets the weekly time target recommended.	A1		
	(c)	Time taken for three jogs $= \dfrac{5.54}{9.5} \times 60 \times 3 = 104.9684211$ minutes > 75 minutes	M1		
		She will meet her weekly target for time.	A1		
		Calories used for walking $= \dfrac{153.41538...}{30} \times 150 = 767.0769231$ calories	M1		
		Calories used for jogging $= \dfrac{104.9684211}{30} \times 345 = 1207.136843$ calories	M1		
		Double of calories used for walking $= 2 \times 767.0769231$ $= 1534.153846 \neq 1534.153846$	M1	Comparison seen	
		She will not use more than double the amount of calories in jogging than walking.	A1		
					[10]

END OF MARKING SCHEME