General Certificate of Education Ordinary Level 2020
Mathematics 4048/02
Syllabus 4048 Paper 2
SUGGESTED Solutions & Marking Scheme Mark Allocation
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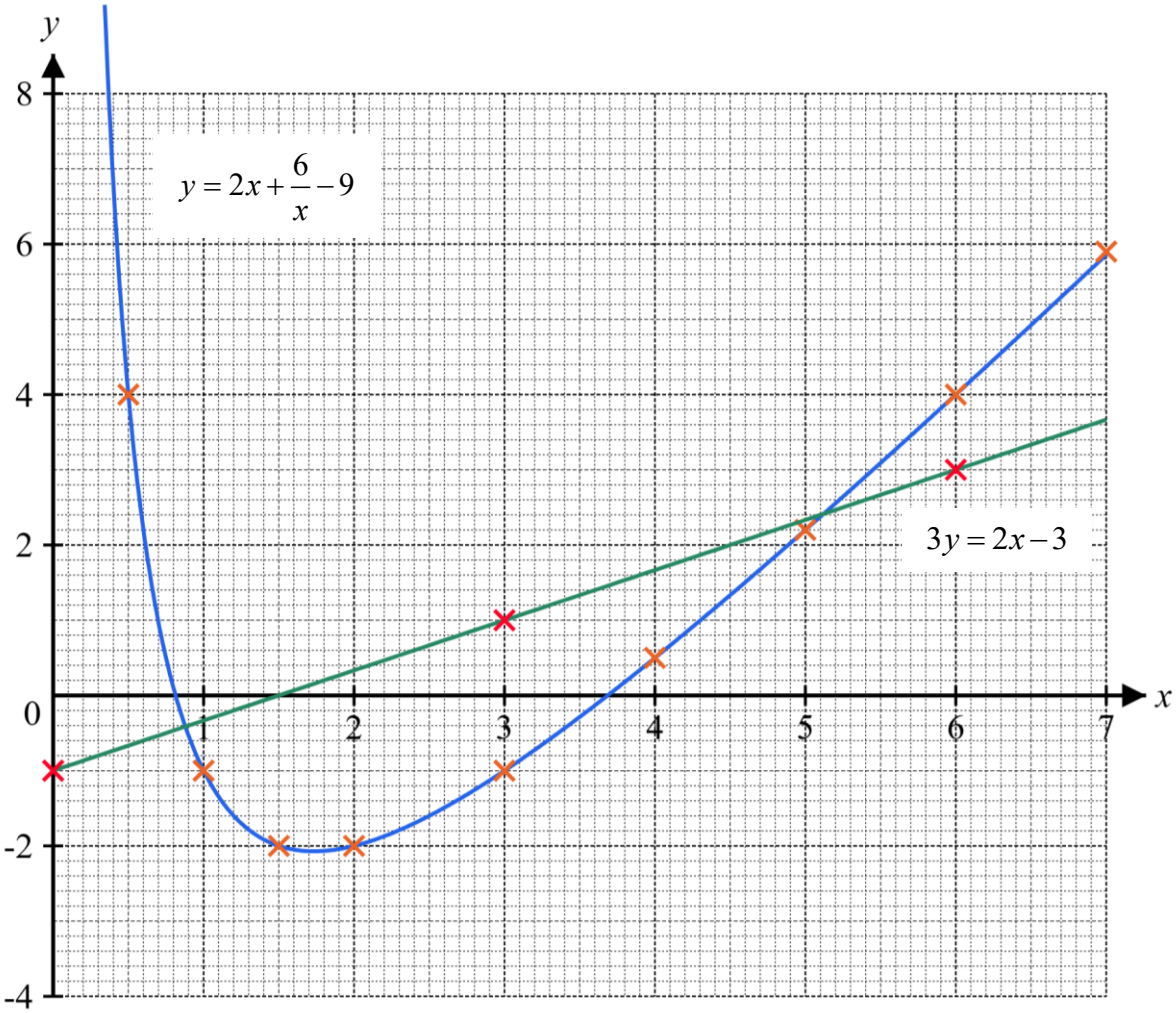
1	(a)	$\frac{2x+1}{2} \geq \frac{5-4x}{3}$ $6x+3 \geq 10-8x$	M1	Remove fraction	
		$14x \geq 7$ $x \geq \frac{1}{2}$	A1	o.e.	
	(b)	$6x-3y=16 \ ---(1)$ $9x+2y=11 \ ---(2)$ $(1)\times 2 : 12x-6y=32 \ ---(3)$ $(2)\times 3 : 27x+6y=33 \ ---(4)$			
		$(3)+(4)$ $39x=65$	M1	Elimination or substitution s.o.i.	
		$x=\frac{5}{3}$	A1	o.e.	
		$y=-2$	A1		
	(c)	$\frac{x-5(3-2x)}{(3-2x)^2}$	M1	Join fraction	
		$=\frac{x-15+10x}{(3-2x)^2}$ $=\frac{11x-15}{(3-2x)^2}$	A1		
	(d)	$\left(\frac{a^9}{27b^{15}}\right)^{\frac{1}{3}}$	M1	Resolve negative index or M0	
		$=\frac{3b^5}{a^3}$	A1	or B1 for '3' or B1 for $\frac{b^5}{a^3}$	
	(e)	$\frac{4\left(x^2-4\right)}{(3x-5)(x+2)}=\frac{4(x+2)(x-2)}{(3x-5)(x+2)}$	M2	M1 for each factorisation	
		$=\frac{4(x-2)}{3x-5}$	A1	o.e.	
					[12]

2	(a)	7 girls	B1		
	(b)	$\mathbf{F} = \begin{pmatrix} 30 \\ 26 \\ 24 \end{pmatrix}$	B1		
	(c)	$\mathbf{M} = \begin{pmatrix} 996 \\ 1316 \end{pmatrix}$	B2	B1 for each correct element	
	(d)	The total fees collected by the holiday club for one morning is \$996 and one afternoon is \$1316.	B1		
	(e)	\$11560	B1		
	(f)	Number of children in P $= 1.5 \times (10 + 14) = 36$ Number of children in Q $= 1.5 \times (12 + 16) = 42$ Number of children in R $= 0.75 \times (16 + 20) = 27$	M1		
		Total fees in Week 2 $= 5 \times (36 \times \$30 + 42 \times \$26 + 27 \times \$24) = \$14100$	M1		
		Percentage change $= \frac{14100 - 11560}{11560} \times 100\% = 21.97231834\%$			
		22.0% increase	A1	o.e.	
					[9]

3	(a)	5.9	B1		
	(b)	Refer to graph on page 4			
		Plotting of any 6 correct points	P1		
		Plotting of all 9 points correctly	P1		
		Smooth curve passing through all plotted points	C1		
	(c)	$x = 0.7$ or 4.3	B2	Accept ± 0.1	
	(di)	Plotting of any 3 relevant points	P1		
		Line drawn passing through plotted points	L1		
	(dii)	$x = 0.9$ or 5.1	B2	Accept ± 0.1	
	(diii)	$3\left(2x + \frac{6}{x} - 9\right) = 2x - 3$	M1	Substitution seen o.e.	
		$6x^2 + 18 - 27x = 2x^2 - 3x$ $4x^2 - 24x + 18 = 0$ $2x^2 - 12x + 9 = 0$			
		$A = -12$	A1		
		$B = 9$	A1		
					[13]


y
x
8
6
4
2
0
-2
-4
1
2
3
4
5
6
7
$y = 2x + \frac{6}{x} - 9$
$3y = 2x - 3$

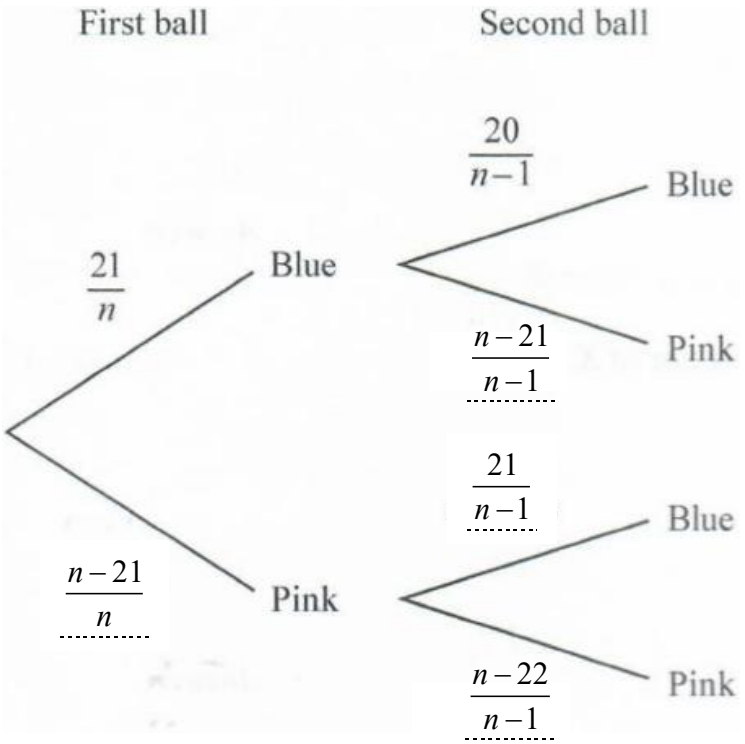
4	(a)	Using cosine rule, $AC = \sqrt{660^2 + 950^2 - 2(660)(950)\cos 80°}$	M2	M1 for formula M1 for substitution	
		$= 1058.463597$ m $= 1060$ m (3 s.f.)	A1 AG		
	(b)	Using sine rule, $\frac{\sin \angle ADC}{1058.463597} = \frac{\sin 24°}{480}$ $\sin \angle ADC = \frac{1058.463597 \sin 24°}{480}$	M1	Apply sine rule formula	
		Angle ADC $= 180° - \sin^{-1}\left(\frac{1058.463597 \sin 24°}{480}\right)$ $= 116.2454077°$	M1		
		Bearing of D from C $= 360° - (180° - 116.2454077°)$ $= 296.2454078° = 296.2°$ (1 d.p.)	A1		
	(c)	Time taken $= \frac{(600 + 950 + 1058.463597) \div 1000}{9.5}$	M1		
		$= 16.85345429$ mins $= 16$ mins 50 secs (nearest 10 seconds)	A2		
					[9]

5	(a)	By Pythagoras's Theorem, Slant height $=\sqrt{5.5^2+8^2}=\sqrt{94.25}$	M1		
		Curved surface area $=\pi(5.5)\left(\sqrt{94.25}\right)$	M1		
		$=167.7464128\text{ cm}^2=168\text{ cm}^2$ (3 s.f.)	A1		
	(bi)	$\dfrac{\text{Volume of water}}{\text{Volume of glass}}=\left(\dfrac{6}{8}\right)^3=\dfrac{27}{64}\neq 75\%$	B1		
		Hence, it is incorrect to say that the glass is filled to 75% of its capacity.	AG		
	(bii)	Percentage $=\left(\dfrac{6}{8}\right)^3\times 100\%$	M1		
		$=42.1875\%$	A1	c.a.o	
	(biii)	Volume of glass $=\dfrac{1}{3}\pi(5.5)^2(8)=\dfrac{242}{3}\pi$	M1		
		Volume of water $=\dfrac{242}{3}\pi\times 42.1875\%=\dfrac{1089}{32}\pi$	M1		
		Let the radius of the cylindrical glass be r.			
		$\pi r^2(2.5)=\dfrac{1089}{32}\pi$ $r^2=\dfrac{1089}{80}$	M1	Make r the subject	
		$r=\sqrt{\dfrac{1089}{80}}=3.689512162875=3.69\text{ cm}$ (3 s.f.)	A1		
					[10]

6	(ai)	$BF = CF$ (tangents from external points are equal) $DF = EF$ (tangents from external points are equal) Angle BFD = Angle CFE (vertically opposite angles)	M2	M1 for any two correct statements M1 for all correct	
		Hence, triangles BDF and CEF are congruent. (SAS Congruency Test)	A1	Must state SAS	
	(aii) (a)	$(90-x)°$	B1		
	(aii) (b)	$2x°$	B1		
	(bi)	Arc length $= 12(2\pi - 1.8)$	M1		
		$= 53.79822369$ cm $= 53.8$ cm (3 s.f.)	A1		
	(bii)	Area of triangle $KLM = \frac{1}{2}(12)^2 \sin 1.8 = 72\sin 1.8$	M1		
		Area of major sector $= \frac{1}{2}(12)^2(2\pi - 1.8) = 144\pi - 129.6$	M1		
		Percentage of area that is shaded $= \frac{\pi(12)^2 - 72\sin 1.8 - 144\pi + 129.6}{\pi(12)^2} \times 100\%$	M1		
		$= 13.14862333\% = 13.1\%$ (3 s.f.)	A1		
					[11]

7	(a)	Mean $= \dfrac{1(10)+2(13)+3(9)+4(6)+5q+6(2)}{50} = 2.68$	M1	Knows to use mean formula s.o.i.	
		$5q+99=134$ $5q=35 \Rightarrow q=7$	A1		
		Total number of students $=50$ $p+7+40=50$ $p=3$	A1		
	(b)	SD $=1.59$	B1	c.a.o.	
	(c)	On average, the students watched more movies than the adults as the mean of 2.68 is higher than the adults' of 2.04.	B1	Must state values	
		The number of movies watched by the students is more consistent than the adults as the standard deviation of 1.59 is higher than the adults' of 1.92.	B1	Must state values	
					[6]

8	(a)	$AB = \sqrt{(-7-(-4))^2 + (-1-5)^2}$	M1		
		$= 6.708203932$ units $= 6.71$ units (3 s.f.)	A1		
	(b)	Gradient of $CD = \dfrac{5-(-1)}{-4-(-7)} = 2$	M1		
		$\overrightarrow{BC} = \begin{pmatrix} 8 \\ -2 \end{pmatrix}$ $\overrightarrow{OC} - \overrightarrow{OB} = \begin{pmatrix} 8 \\ -2 \end{pmatrix}$ $\overrightarrow{OC} = \begin{pmatrix} 8 \\ -2 \end{pmatrix} + \begin{pmatrix} -4 \\ 5 \end{pmatrix} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$	M1	Finds $\overrightarrow{OC}$ o.e.	
		$y = 2x + c$ $3 = 2(4) + c \Rightarrow c = -5$	M1		
		$y = 2x - 5$	A1		
	(ci)	$\overrightarrow{AC} = \begin{pmatrix} 4 \\ 3 \end{pmatrix} - \begin{pmatrix} -7 \\ -1 \end{pmatrix} = \begin{pmatrix} 11 \\ 4 \end{pmatrix}$	M1		
		$\overrightarrow{XC} = \dfrac{1}{2}\overrightarrow{AC} = \begin{pmatrix} 5.5 \\ 2 \end{pmatrix}$	A1	o.e.	
	(cii)	$\overrightarrow{OX} = \begin{pmatrix} -1.5 \\ 1 \end{pmatrix}$	B1	o.e.	
					[9]

9	(a)		B2	B1 for any two correct B1 for all correct Deduct B1 for any un-simplified fraction given	
	(b)	$\frac{n-21}{n}\times\frac{n-22}{n-1}=\frac{1}{8}$	M1	Form equation	
		$\frac{n^2-21n-22n+462}{n^2-n}=\frac{1}{8}$	M1	Expand	
		$8n^2-344n+3696=n^2-n$ $7n^2-343n+3696=0$ $n^2-49n+528=0$ (Shown)	A1 AG		
	(c)	$n=\frac{-(-49)\pm\sqrt{(-49)^2-4(1)(528)}}{2(1)}$	M1	Factorisation o.e.	
		$n=16$ or 33	A2	A1 for each value	
	(d)	$n=16$ must be rejected as n must be at least 21.	B1	o.e.	
	(e)	$\frac{21}{33}\times\frac{12}{32}\times 2$	M1	One case seen	
		$=\frac{21}{44}$	A1		
					[12]

10	(ai)	£1 = \$1.824	B1	c.a.o.	
	(aii)	Least possible cost $= \$217 \times 1.796 = \$389.732$ Greatest possible cost $= \$217 \times 1.860 = \$403.62$	M1	Either exchange rate seen	
		Greatest difference $= \$403.62 - \$389.732 = \$13.888 = \$13.88$ (2 d.p.)	A1		
	(b)	Total annual cost $= 52(217 + 60 + 57 + 25 + 15) + 12(56.90) = £20130.80$	M1		
		Total annual cost with extra $= 115\% \times 20130.80 = £23150.42$	M1	FT from their annual costs s.o.i.	
		EITHER Justification (1) for choosing exchange rate: The past 12 months is the most relevant year to be used as a reference and to be prudent, the lowest exchange rate should be used in calculations.	*B1*	Either (1) or (2) are accepted as reasons for calculations. Other reasonable justifications supporting (1) or (2) are accepted.	
		OR Justification (2) for choosing exchange rate: The past 24 months are equally relevant as the exchange rates change drastically and to be prudent, the lowest exchange rate should be used in calculations.	*B1*		
	(1)	Amount in Dollars for Justification (1) $= \dfrac{23150.42}{0.542}$	*M1*	0.542 s.o.i.	
		$= \$42712.95203$	*A1*		
	(2)	Amount in Dollars for Justification (2) $= \dfrac{23150.42}{0.503}$	*M1*	0.503 s.o.i.	
		$= \$46024.69185$	*A1*		
		A suitable amount for Ying's parents to give her is \$42720 / \$46030 as it is a convenient amount and is slightly more than the actual amount in dollars.	B1	Justify clearly an amount for Ying's parents to give	
		Acceptable reasons/justifications to the amount Ying's parents should give her: You are allowed to modify the suggested amount if it satisfies at least **two** of the following criteria: • The amount is an integer correct to the nearest one, ten, hundred, etc. (must be rounded up) • Costs are logical and economical (i.e. not logical to round to the nearest thousand or ten thousand) • The final amount can be paid in cash/coins (i.e. costs like \$42712.96 are not accepted, **unless** it is stated that the amount is given using a cashless method e.g. bank transfer or PayNow)			
					[9]

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