Question 1 (2020 Paper 2 Q1)

Q1	Model Solution – 25 Marks	Marking Notes
(a)	Slope of BC $m = \frac{3+12}{-4-6} = -\frac{3}{2}$ Equation BC $\quad 3x + 2y + 6 = 0.$ Perp. Distance from A to line BC $\frac{3(2)+2(-6)+6}{\sqrt{3^2+2^2}} = \frac{6-12+6}{\sqrt{13}} = \frac{0}{\sqrt{13}} = 0.$ Therefore A, B and C are collinear.	**Scale 15D (0, 4, 7, 11, 15)** *Low Partial Credit:* Slope formula with some substitution Equation of line formula with some substitution Effort at finding are of triangle ABC *Mid Partial Credit:* Equation of BC *High Partial Credit:* Perp. Distance formula with some substitution from relevant line Area of triangle $ABC = 0$ but perp. distance not explicit *Full credit* (-1) Distance $= 0$ but conclusion omitted Area of triangle $ABC = 0$ **and** perp. dist. $= 0$ but conclusion omitted

(b)	Slope of $a = \frac{1}{2}$ Slope of $b = \tan 60° = \sqrt{3}$ $\tan\theta = \pm\frac{\sqrt{3}-\frac{1}{2}}{1+\frac{\sqrt{3}}{2}} = \pm\frac{2\sqrt{3}-1}{2+\sqrt{3}}$ $= \pm\frac{(2\sqrt{3}-1)(2-\sqrt{3})}{(2+\sqrt{3})(2-\sqrt{3})}$ $= \pm(-8+5\sqrt{3})$ $\theta = \tan^{-1}(-8+5\sqrt{3})$ $\theta = 33{\cdot}435°$ **Or** $\theta + \tan^{-1}\frac{1}{2} + 120° = 180°$ $\theta + 26{\cdot}565° + 120° = 180°$ $\theta = 33{\cdot}435°$	**Scale 10D (0, 3, 5, 8, 10)** *Low Partial Credit:* Slope of $a = \frac{1}{2}$ Slope of $b = \tan 60°$ *Mid Partial Credit:* Tan formula with some relevant substitution *High Partial Credit:* Tan formula fully substituted *Full credit* (–1) $\theta = +\tan^{-1}(-8+5\sqrt{3})$ **Scale 10D (0, 3, 5, 8, 10)** *Low Partial Credit:* Slope of $a = \frac{1}{2}$ $120°$ *Mid Partial Credit:* $\tan^{-1}\frac{1}{2} + 120°$ *High Partial Credit:* $\theta + 26{\cdot}565° + 120° = 180°$ and fails to finish

Question 2 (2019 Paper 2 Q2)

Q2	Model Solution – 25 Marks	Marking Notes
(a)	$m = \frac{b-0}{0-a} = \frac{-b}{a}$ $y - 0 = \frac{-b}{a}(x - a)$ $ay = -bx + ab$ $bx + ay = ab$ Now divide across by ab $\frac{x}{a} + \frac{y}{b} = 1$	**Scale 10C (0, 4, 7, 10)** *Low Partial Credit:* Slope formula with some substitution *High Partial Credit:* Equation of line formula fully substituted
	Or $m = \frac{b-0}{0-a} = \frac{-b}{a}$ $y = mx + c \;\; => \;\; y = \frac{-b}{a}x + c$. But (o, b) is on this line, thus $b = \frac{-b}{a}(o) + c$ $\therefore \; b = c$ Equation $y = \frac{-b}{a}x + b$ $ay = -bx + ab$ $bx + ay = ab$ Now divide across by ab $\frac{x}{a} + \frac{y}{b} = 1$	*Low Partial Credit:* Slope formula with some substitution *High Partial Credit:* m expressed in terms of *a* and *b*, ***and*** c in terms of *b*
	Or $(a, 0) \in y = mx + c => 0 = ma + c$ $=> -ma = c$ $(0, b) \in y = mx + c => b = c$ $\therefore -ma = b => m = \frac{-b}{a}$ Equation $y = \frac{-b}{a}x + b$ $ay = -bx + ab$ $bx + ay = ab$ Now divide across by ab $\frac{x}{a} + \frac{y}{b} = 1$	
	Or $\frac{x}{a} + \frac{y}{b} = 1$ LHS: $\frac{x}{a} + \frac{y}{b}$ $(a, 0)$: $\frac{a}{a} + \frac{0}{b}$ = 1=1 or RHS $(0, b)$: $\frac{0}{a} + \frac{b}{b}$ = 1=1 or RHS	*Low Partial Credit:* $(a, 0)$ or ($(0, b)$ correctly substituted e.g. $\frac{a}{a} + \frac{0}{b}$ *High Partial Credit:* $(a, 0)$ **and** $(0, b)$ correctly substituted

(b) (i)	$y - 0 = m(x-6)$ <u>or</u> $y = m(x-6)$ Or $y = mx - 6m$ Or $y = mx + c$ $\therefore 0 = 6m + c \Rightarrow c = -6m$	**Scale 5B (0, 2, 5)** *Mid Partial Credit:* Equation of line formula with some relevant substitution
(b) (ii)	$y = m(x-6)$ $4x + 3y = 25$ => $4x + 3m(x-6) = 25$ $=> x = \frac{25+18m}{3m+4}$ Substitute this into $y = m(x-6)$ $y = m\left(\frac{25+18m}{3m+4}\right) - 6m$ $= \frac{25m + 18m^2 - 18m^2 - 24m}{3m+4}$ $= \frac{m}{3m+4}$ Or $4x + 3y = 25 \cap mx - y = 6m$ $4x + 3y = 25$ $\underline{3mx - 3y = 18m}$ $4x + 3mx = 18m + 25$ $x = \frac{25+18m}{3m+4}$ $4mx + 3my = 25m$ $\underline{4mx - 4y = 24m}$ $(3m+4)y = m$ $\therefore y = \frac{m}{3m+4}$	**Scale 10D (0, 4, 5, 8, 10)** *Low Partial Credit:* Indication of use of simultaneous equations *Mid Partial Credit* One relevant substitution *High Partial Credit:* x or y value found *Low Partial Credit:* Indication of use of simultaneous equations *Mid Partial Credit* One successful elimination in equations *High Partial Credit:* x or y value found

Question 3 (2018 Paper 2 Q5)

(a)	2(-2) + 3(1) + 1 = 0 or $-4+3+1=0$	**Scale 10C (0, 3, 7, 10)** *Low Partial Credit:* Substitution for x **or** y in equation of line *High Partial Credit:* Substitution for x **and** y in eq. of line (LHS when no indication of 0)
(b)	Slope of *m* or *n* = $\frac{-2}{3}$ Slope of *AB* is $\frac{3}{2}$ and (−2, 1) is on *AB* $y-1=\frac{3}{2}(x-(-2))$ equation of *AB* is $3x-2y+8=0$ Solve for (x,y) between $3x-2y+8=0$ and $2x+3y-51=0$ $n \cap AB=(6,13)=B$ **Or** coordinates of $B(x,y)$ $\lvert AB\rvert=\sqrt{(x+2)^2+(y-1)^2}$ Perp. distance (−2, 1) to $2x+3y-51=0$ $\left\lvert\frac{-4+3-51}{\sqrt{13}}\right\rvert=\frac{52}{\sqrt{13}}=4\sqrt{13}$ $\therefore (x+2)^2+(y-1)^2=(4\sqrt{13})^2$ Substituting $x=\frac{1}{2}(-3y+51)$ $(\frac{-3y+55}{2})^2+(y-1)^2=(4\sqrt{13})^2$ $13y^2-338y+2197=0$ $y^2-26y+169=0$ $(y-13)^2=0\rightarrow y=13$ $n \cap AB=(6,13)=B$	**Scale 10D (0, 3, 5, 8, 10)** *Low Partial Credit:* Slope of *AB* Equation of line formula with some substitution *Mid Partial Credit:* Equation of *AB* *High Partial Credit:* Effort at finding intersection of lines **Note**: Point of intersection, found correctly, of *n* and a relevant *AB* (with errors) merits Mid Partial Credit at least. Method 2 *Low Partial Credit:* Perpendicular distance formula with some substitution Distance formula with some substitution *Mid Partial Credit:* Quadratic equation in x and y *High Partial Credit:* Quadratic equation in either x or y

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<td>(c)</td>
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$\overrightarrow{AB} = x$ up 8 and y up 12
Centre of s is $\frac{1}{8}(8) - 2 = -1 = h$
and $\frac{1}{8}(12) + 1 = 2{\cdot}5 = k$
Eqn s: $(x+1)^2 + (y - 2{\cdot}5)^2 = \left(\frac{\sqrt{13}}{2}\right)^2$
Or
$s \cap t$
$\left(\frac{3(-2)+1(6)}{3+1}, \frac{3(1)+1(13)}{3+1}\right) = (0, 4)$
Centre s: $\left(\frac{0-2}{2}, \frac{4+1}{2}\right) = (-1,\ 2{\cdot}5)$
Radius : distance $(-1, 2{\cdot}5)$ to either $(-2, 1)$or $(0, 4)$ or calculated otherwise $\sqrt{3{\cdot}25}$ or $\frac{\sqrt{13}}{2}$
$(x+1)^2 + (y - 2{\cdot}5)^2 = \left(\frac{\sqrt{13}}{2}\right)^2$
Or
using ratio 1 : 7 centre s:
$\left(\frac{1(6)+7(-2)}{1+7}, \frac{1(13)+7(1)}{1+7}\right) = (-1, 2{\cdot}5)$
Radius as above or $\frac{1}{8}|AB| = \frac{\sqrt{13}}{2}$
$(x+1)^2 + (y - 2{\cdot}5)^2 = \left(\frac{\sqrt{13}}{2}\right)^2$
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Scale 5C (0, 2, 4, 5)
Low Partial Credit:
8 up or 12 up
Indication $4\sqrt{13}$ from(b) of relevance
High Partial Credit:
Centre and radius of circle

Low Partial Credit:
Some relevant use of 1 : 3
Midpoint of AB found once but no further work of relevance
Formula with some relevant substitution
High Partial Credit:
Centre and radius of circle

Low Partial Credit:
Some relevant use of 1 : 7
Formula with some relevant substitution
High Partial Credit:
Centre and radius of circle
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