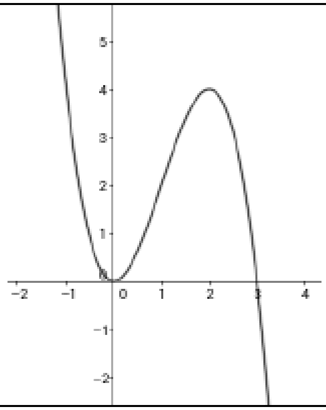
Revision Paper 1 – Answers

Question			Answer	Marks	Guidance	
1	(i)		$4x^2 - 12x + 9 - 2(9 - 6x + x^2)$ $2x^2 - 9$	**M1** **A1** **[2]**	Square to get at least one 3/4 term quadratic Fully correct www	**ISW** after correct answer
1	(ii)		$-6x^3 - 4x^3$ -10	**B1** **B1** **[2]**	$-6x^3$ **or** $-4x^3$ soi www in these terms Condone $-10x^3$	Ignore other terms If only embedded in full expansion then award **B1B0**
2			$\frac{3+\sqrt{20}}{3+\sqrt{5}} \times \frac{3-\sqrt{5}}{3-\sqrt{5}}$ $\frac{-1+3\sqrt{5}}{9-5}$ $-\frac{1}{4}+\frac{3}{4}\sqrt{5}$	**M1** **B1** **A1** **A1** **[4]**	Attempt to rationalise the denominator – must attempt to multiply $\sqrt{20} = 2\sqrt{5}$ soi Either numerator or denominator correct and simplified to no more than two terms Fully correct and fully simplified. Allow $\frac{-1+3\sqrt{5}}{4}$, order reversed etc. **Do not ISW** if then multiplied by 4 etc.	Alternative: **M1** Correct method to solve simultaneous equations formed from equating expression to $a\sqrt{5}+b$ **B1** $\sqrt{20} = 2\sqrt{5}$ soi **A1** Either a or b correct **A1** Both correct
3			$x^2 + (3x+4)^2 = 34$ $10x^2 + 24x - 18 = 0$ $5x^2 + 12x - 9 = 0$ $(5x-3)(x+3) = 0$ $x = \frac{3}{5}, x = -3$ $y = \frac{29}{5}, y = -5$	**M1*** **A1** **M1dep*** **A1** **A1** **[5]**	Substitute for x/y or valid attempt to eliminate one of the variables Correct three term quadratic in solvable form Attempt to solve resulting three term quadratic Correct x values Correct y values	If x eliminated: $10y^2 - 8y + 290 = 0$ $5y^2 - 4y + 145 = 0$ $(5y-29)(y+5) = 0$ Award **A1 A0** for one pair correctly found from correct quadratic **Spotted solutions:** **If M0 DM0** **SC B1** $x = \frac{3}{5}, y = \frac{29}{5}$ www **SC B1** $x = -3, y = -5$ www Must show on both line and curve (Can then get 5/5 if both found www and exactly two solutions justified)

Question			Answer	Marks	Guidance	
4			Let $y^{\frac{1}{4}} = x$ $2x^2 - 7x + 3 = 0$ $(2x-1)(x-3) = 0$ $x = \frac{1}{2}, x = 3$ $y = \left(\frac{1}{2}\right)^4, y = 3^4$ $y = \frac{1}{16}, y = 81$	**M1*** **M1dep*** **A1** **M1dep*** **A1** **[5]**	Use a substitution to obtain a quadratic or factorise into two brackets each containing $y^{\frac{1}{4}}$ Correct method to solve resulting quadratic Both values correct Attempt to raise to the fourth power Correct final answers	**No marks** if whole equation raised to fourth power etc. **No marks** if straight to formula with no evidence of substitution at start and no raising to fourth power/fourth rooting at end. **No marks** if $y^{\frac{1}{4}} = x$ and then $2x - 7x^2 + 3 = 0$. **Spotted solutions:** **If M0 DM0** or **M1 DM0** **SC B1** $y = 81$ **www** **SC B1** $y = \frac{1}{16}$ **www** (Can then get 5/5 if both found **www** and exactly two solutions justified)
			<u>Alternative by rearrangement and squaring:</u> $2y^{\frac{1}{2}} - 7y^{\frac{1}{4}} + 3 = 0,\ 7y^{\frac{1}{4}} = 2y^{\frac{1}{2}} + 3$ $49y^{\frac{1}{2}} = 4y + 12y^{\frac{1}{2}} + 9,\ 37y^{\frac{1}{2}} = 4y + 9$ $16y^2 - 1297y + 81 = 0$ $(16y-1)(y-81) = 0$ $y = \frac{1}{16}, y = 81$	**M2*** **A1** **M1dep*** **A1**	Rearrange and square both sides twice Correct quadratic obtained Correct method to solve resulting quadratic Correct final answers	
			OR methods may be combined: e.g. after $37y^{\frac{1}{2}} = 4y + 9$ $4y - 37y^{\frac{1}{2}} + 9 = 0$ $4x^2 - 37x + 9 = 0$ $(4x-1)(x-9) = 0$ $x = \frac{1}{4}, x = 9$ $y = \left(\frac{1}{4}\right)^2, y = 9^2$	**M1*** **M1dep*** **A1** **M1dep*** **A1** **[5]**	Rearrange, square both sides and substitute Correct method to solve resulting quadratic Attempt to square Correct final answers	

Question			Answer	Marks	Guidance	
5	(i)		$(2^{-2})^3$ or $2^{15} \div 2^{21}$ 2^{-6}	B1 B1 [2]	Valid attempt to simplify Correct answer. Accept $p = -6$.	Correct use of either index law $\left(\frac{1}{2}\right)^6$ **oe is B1**
5	(ii)		$5\times\left(2^2\right)^{\frac{2}{3}}+3\times\left(2^4\right)^{\frac{1}{3}}$ $=5\times2^{\frac{4}{3}}+3\times2^{\frac{4}{3}}\ or\ 10\times2^{\frac{1}{3}}+6\times2^{\frac{1}{3}}$ $=8\times2^{\frac{4}{3}}$ $=2^{\frac{13}{3}}$	M1 B1 A1 [3]	Attempts to express both terms or a combined term as a power of 2 Correctly obtains $2^{\frac{4}{3}}$ or $2^{\frac{1}{3}}$ for **either** term Correct final answer	e.g. **Both** $4 = 2^2$ **and** $16 = 2^4$ **soi** If **M0** **SC B1** for $8\times16^{\frac{1}{3}}$ or $8\times4^{\frac{2}{3}}$
6	(i)		$-2(x^2-6x-2)$ $=-2[(x-3)^2-2-9)]$ $=-2(x-3)^2+22$	B1 B1 M1 A1 [4]	or $a = -2$ $b = -3$ $4 + 2b^2$ $c = 22$ If a, b and c found correctly, then **ISW** slips in format. **If signs of all terms changed at start, can only score SC B1** for fully correct working to obtain $2(x-3)^2 - 22$ If done correctly and then signs changed at end, do not **ISW**, award **B1B1M1A0**	$-2(x-3)^2-22$ **B1 B1 M0 A0** $-2(x-3)+22$ **4/4 (BOD)** $-2(x-3x)^2+22$ **B1 B0 M1 A0** $-2(x^2-3)^2+22$ **B1 B0 M1 A0** $-2(x+3)^2+22$ **B1 B0 M1 A0** $-2x(x-3)^2+22$ **B0 B1 M1 A0** $-2(x^2-3)+22$ **B1 B0 M1 A0**
6	(ii)		(3, 22)	B1ft B1ft [2]	Allow follow through "$-$ their b" Allow follow through "their c"	May restart. Follow through marks are for **their final answer** to (i)

Question			Answer	Marks	Guidance	
7	(i)			B1 B1 B1 [3]	Negative cubic with a max and a min Cubic that meets y-axis at (0, 0) only Double root at (0,0) and single root at (3, 0) and no other roots	For **first mark** must clearly be a cubic – must not stop at or before x axis, do not allow straight line sections drawn with a ruler/tending to extra turning points etc. Must not be a finite plot.
7	(ii)		$y=(x-2)^2(5-x)$ or $y=3(x-2)^2-(x-2)^3$	M1 A1 [2]	Translates curve by +2 or – 2 parallel to the x-axis; must be consistent Fully correct, must have "$y=$". ISW expansions	e.g. for M1 $(x-2)^2(3-(x-2))$ but not $(x-2)^2(3-x-2)$
7	(iii)		Stretch Scale factor one-half parallel to the y-axis	B1 B1 [2]	**Must** use the word "stretch" **Must** have "factor" or "scale factor". For "parallel to the y axis" allow "vertically", "in the y direction".	Do **not** accept "in/on/across/up the y axis". Allow second B1 after "squash" etc. but not after "translate" etc.
8	(i)		$y_1=50,\ y_2=2(5+h)^2$ $\dfrac{(50+20h+2h^2)-50}{(5+h)-5}$ $20+2h$	B1 M1 A1 [3]	Finds y coordinates at 5 and $5+h$ Correct method to find gradient of a line segment; at least 3/4 values correct Fully correct working to give answer **AG**	Need not be simplified
8	(ii)		e.g. "As h tends to zero, the gradient will be 20"	B1 [1]	Indicates understanding of limit **See Appendix 2 for examples**	e.g. refer to h tending to zero or substitute $h=0$ into $20+2h$ to obtain gradient at A
8	(iii)		Gradient of normal $=-\dfrac{1}{20}$ $y-50=-\dfrac{1}{20}(x-5),\ x=0$ $50\frac{1}{4}$	B1 M1 A1 [3]	Gradient of line must be numerical negative reciprocal of their gradient at A through their A Correct coordinate in any form e.g. $\dfrac{201}{4},\ \dfrac{1005}{20}$	Any correct method e.g. labelled diagram.

Question			Answer	Marks	Guidance	
9			$x^2+(2-2k)x+11+k=0$ $(2-2k)^2-4(11+k)$ $4k^2-12k-40>0$ $k^2-3k-10>0$ $(k-5)(k+2)$ $k<-2,\ k>5$	**M1*** **M1dep*** **A1** **M1dep*** **A1** **M1dep*** **A1** **[7]**	Attempt to rearrange to a three-term quadratic Uses b^2-4ac, involving k and not involving x Correct simplified inequality obtained **www** Correct method to find roots of 3-term quadratic 5 and – 2 seen as roots $b^2-4ac>0$ and chooses "outside region" Fully correct, strict inequalities.	Each Ms depend on the previous M $-2>k>5$ scores **M1A0** Allow "$k<-2$ or $k>5$" for A1 **Do not allow "$k<-2$ and $k>5$"**
10	**(i)**		Centre of circle (4, 3) $(x-4)^2-16+(y-3)^2-9-20=0$ $r^2=45$ $r=\sqrt{45}$	**B1** **M1** **A1** **[3]**	Correct centre $(x\pm4)^2-4^2$ and $(y\pm3)^2-3^2$ seen (or implied by correct answer) $\sqrt{45}$ or better **www**	Or $r^2=4^2+3^2+20$ soi **ISW** after $\sqrt{45}$
10	**(ii)**		At A, $y=0$ so $x^2-8x-20=0$ $(x-10)(x+2)=0$ A = (10, 0) Gradient of radius = $\dfrac{3-0}{4-10}=-\dfrac{1}{2}$ Gradient of tangent = 2 $y-0=2(x-10)$ $y=2x-20$	**M1** **A1** **M1** **B1** **M1** **A1** **[6]**	Valid method to find A e.g. put $y=0$ and attempt to solve quadratic (allow slips) or Pythagoras' theorem Correct answer found Attempts to find gradient of radius (3 out of 4 terms correct for their centre, their A) Equation of line **through their A**, any non-zero gradient Correct answer in any three-term form	Alterative for finding gradient: **M1** Attempt at implicit differentiation as evidenced by $2y\dfrac{dy}{dx}$ term **A1** $2x+2y\dfrac{dy}{dx}-8-6\dfrac{dy}{dx}=0$ and substitution of (10, 0) to obtain 2.
10	**(iii)**		A' = (–2, 6) $y-6=2(x+2)$ $y=2x+10$	**B1** **M1** **A1** **[3]**	Finds the opposite end of the diameter Line through their A' parallel to their line in (ii) Correct answer in any three-term form	 Not through centre of circle
10	**(iv)**		OC = $\sqrt{3^2+4^2}=5$ $(0<)\ r<\sqrt{45}-5$	**M1** **A1** **[2]**	Attempts to find the distance from O to their centre **and subtract from their radius** Correct inequality, condone $\le$	**ISW** incorrect simplification

Question			Answer	Marks	Guidance	
11			$y = 4x^2 + ax^{-1} + 5$	B1	ax^{-1} soi	
			$\frac{dy}{dx} = 8x - ax^{-2}$	M1	Attempt to differentiate – at least one non-zero term correct	
				A1	Fully correct	
			At stationary point, $8x - ax^{-2} = 0$	M1	Sets their derivative to 0	
			$a = 8x^3$ **oe**	A1	Obtains expression for a in terms of x, or x in terms of a **www**	$x = \frac{\sqrt[3]{a}}{2}$ **oe**, $a = 18x$ **oe** also fine
			When $a = 8x^3$, $y = 32$ $32 = 4x^2 + 8x^2 + 5$	M1	Substitutes their expression and 32 into equation of the curve to form single variable equation	
			$x = \frac{3}{2}$ **oe**	A1	Obtains correct value for x. Allow $x = \sqrt{\frac{27}{12}}$. Ignore $-\frac{3}{2}$ given as well.	or expression for a e.g. $a^{\frac{2}{3}} = 9$
			$a = 27$	A1 [8]	Obtains correct value for a. Ignore -27 given as well.	
			OR			
			$y = 4x^2 + ax^{-1} + 5$	B1	ax^{-1} soi	
			$\frac{dy}{dx} = 8x - ax^{-2}$	M1	Attempt to differentiate – at least one non-zero term correct	
				A1	Fully correct	
			$32 = 4x^2 + ax^{-1} + 5$	M1	Substitutes 32 into equation of the curve to find expression for a	
			$a = 27x - 4x^3$	A1	Obtains expression for a in terms of x **www**	
			At stationary point, $8x - ax^{-2} = 0$ $8x - (27x - 4x^3)x^{-2} = 0$	M1	Sets derivate to zero **and** forms single variable equation	
			$x = \frac{3}{2}$ **oe**	A1	Obtains correct value for x. Allow $x = \sqrt{\frac{27}{12}}$. Ignore $-\frac{3}{2}$ given as well.	
			$a = 27$	A1	Obtains correct value for a. Ignore -27 given as well.	