Year 11 to Year 12 Transition Paper

Quadratics

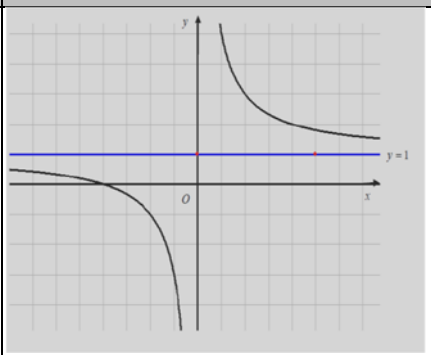
Mark Scheme

Question	Scheme	Marks
1(i)	$x^2-8x+17=(x-4)^2-16+17$	M1
	$=(x-4)^2+1$ with comment (see notes)	A1
	As $(x-4)^2 \ldots 0 \Rightarrow (x-4)^2+1 \ldots 1$ hence $x^2-8x+17>0$ for all x	A1
		(3)
(ii)	For an explanation that it may not always be true Tests say $x=-5 \quad (-5+3)^2=4$ whereas $(-5)^2=25$	M1
	States sometimes true and gives reasons Eg. when $x=5 \quad (5+3)^2=64$ whereas $(5)^2=25$ True When $x=-5 \quad (-5+3)^2=4$ whereas $(-5)^2=25$ Not true	A1
		(2)
		(5 marks)

Question	Scheme	Marks
2(a)	$x^2-10x+23=(x\pm5)^2\pm A$	M1
	$(x-5)^2-2$	A1
		(2)
(b)	$(x\pm5)^2-A \Rightarrow x=\ldots$ or $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a} \Rightarrow x=\ldots$ $\left(x=\dfrac{10\pm\sqrt{10^2-4(1)(23)}}{2}\right)$	M1
	$x=5\pm\sqrt{2}$	A1
		(2)
		(5 marks)

Question	Scheme	Marks
3	$x(1-4x^2)$	B1
	Accept $x(-4x^2+1)$ or $-x(4x^2-1)$ or $-x(-1+4x^2)$ or even $4x(\frac{1}{4}-x^2)$ or equivalent quadratic (or initial cubic) into two brackets	M1
	$x(1-2x)(1+2x)$ or $-x(2x-1)(2x+1)$ or $x(2x-1)(-2x-1)$	A1
		(3)
		(3 marks)

Question	Scheme	Marks
4	Realises that $k = 0$ will give no real roots as equation becomes $3 = 0$ (proof by contradiction)	B1
	(For $k \neq 0$) quadratic has no real roots provided $b^2 < 4ac$ so $16k^2 < 12k$	M1
	$4k(4k-3) < 0$ with attempt at solution	M1
	So $0 < k < \frac{3}{4}$, which together with $k = 0$ gives $0 \leq k < \frac{3}{4}$ (*)	A1
		4(3)
		(4 marks)

Question	Scheme	Marks
5(a)	 $\frac{1}{x}$ shape in 1st quadrant	M1
		A1
	Correct Asymptote $y = 1$	B1
		(3)
(b)	Combines equations $\Rightarrow \frac{k^2}{x} + 1 = -2x + 5$	M1
	$(\times x) \Rightarrow k^2 + 1x = -2x^2 + 5x \Rightarrow 2x^2 - 4x + k^2 = 0$ *	A1*
		(2)
(c)	Attempts to set $b^2 - 4ac = 0$	M1
	$8k^2 = 16$	A1
	$k = \pm\sqrt{2}$	A1
		(3)
		(8 marks)

Question	Scheme		Marks
6(i)	$16a^2 = 2\sqrt{a} \Rightarrow a^{\frac{3}{2}} = \frac{1}{8}$	$16a^2 - 2\sqrt{a} = 0$ $\Rightarrow 2a^{\frac{1}{2}}\left(8a^{\frac{3}{2}} - 1\right) = 0$ $\Rightarrow a^{\frac{3}{2}} = \frac{1}{8}$	M1
	$\Rightarrow a = \left(\frac{1}{8}\right)^{\frac{2}{3}}$	$\Rightarrow a = \left(\frac{1}{8}\right)^{\frac{2}{3}}$	M1
	$\Rightarrow a = \frac{1}{4}$	$\Rightarrow a = \frac{1}{4}$	A1
	Deduces that $a = 0$ is a solution		B1
			(4)
(ii)	$b^4 + 7b^2 - 18 = 0 \Rightarrow \left(b^2 + 9\right)\left(b^2 - 2\right) = 0$		M1
	$b^2 = -9, 2$		A1
	$b^2 = k \Rightarrow b = \sqrt{k}, k > 0$		dM1
	$b = \sqrt{2}$, $-\sqrt{2}$ only		A1
			(4)
			(8 marks)

Question	Scheme	Marks
7(a)	117 tonnes	B1
		(1)
(b)	1200 tonnes	B1
		(1)
(c)	Attempts $\left\{1200 - 3\times(5-20)^2\right\} - \left\{1200 - 3\times(4-20)^2\right\}$	M1
	93 tonnes	A1
		(2)
(d)	States the model is only valid for values of n such that n ,, 20	B1
	States that the total amount mined cannot decrease	B1
		(2)
		(6 marks)

Question	Scheme	Marks
8(a)	Attempts $P = 100 - 6.25(15-9)^2$	M1
	$= -125$ $\therefore$ not sensible as the company would make a loss	A1
		(2)
(b)	Uses $P > 80 \Rightarrow (x-9)^2 < 3.2$ or $P = 80 \Rightarrow (x-9)^2 = 3.2$	M1
	$\Rightarrow 9 - \sqrt{3.2} < x < 9 + \sqrt{3.2}$	dM1
	Minimum Price = £7.22	A1
		(3)
(c)	States (i) maximum profit =£ 100 000 and (ii) selling price £9	B1 B1
		(2)
		(7 marks)