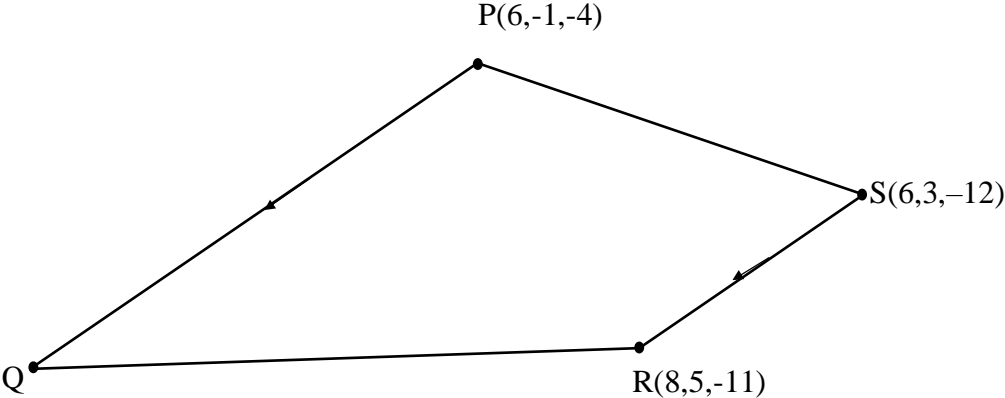
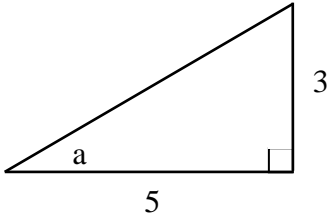
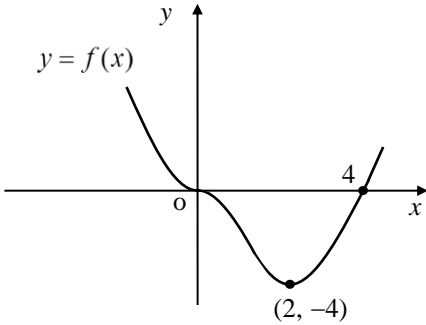
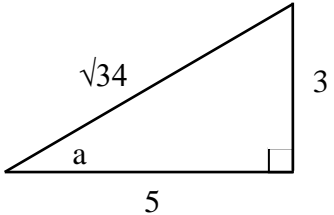


October Higher Extension Test – Unit 1		
1	<p>Three vertices of the quadrilateral PQRS are $P(6,-1,-4)$, $R(8,5,-11)$ and $S(6,3,-12)$.</p>  <p>(a) Given that $\vec{PQ} = 2\vec{SR}$, establish the coordinates of Q.</p> <p>(b) Show that angle PSR is a right angle.</p>	<p>2</p> <p>3</p>
2	<p>Two functions are defined on a suitable domains as $f(x) = x^2 - 1$ and $g(x) = x^2 + 2$</p> <p>Find an expression for $f(g(x))$ in its simplest form</p>	3
3	<p>A right-angled triangle has sides and angles as shown in the diagram. What is the value of $\cos 2a$</p> 	3
4	<p>Part of the graph of the function $y = f(x)$ is shown</p>  <p>Sketch the graphs of the related functions</p> <p>(i) $y = f(x - 2)$</p> <p>(ii) $y = 1 - f(x - 2)$</p>	4

5	<p>(a) Show that $\frac{1}{12} = \frac{1}{3} - \frac{1}{4}$</p> <p>(b) Hence, or otherwise, determine the exact value of $\cos \frac{\pi}{12}$ and $\sin \frac{\pi}{12}$.</p>	1 3
6	The point Q divides the line joining P(-1,-1,0) to R(5,2,-3) in the ratio 2:1. Find the coordinates of Q	3
7	Solve $\log_3(x^2 - 4) - \log_3(x - 2) = 3$	5
8	<p>Before a forest fire was brought under control, the spread of the fire was described by a law of the form $A = A_0 e^{kt}$, where A_0 is the area covered by the fire when it was first detected and A is the area covered by the fire t hours later.</p> <p>If it takes one and a half hours for the area of the forest fire to double, find the value of the constant k</p> <p><i>This is the only calculator question</i></p>	3
	30 marks	

October Higher Extension Test – Answers			
1	<p>a) $\vec{SR} = \begin{pmatrix} 2 \\ 2 \\ 1 \end{pmatrix}$ $2\vec{RS} = \begin{pmatrix} 4 \\ 4 \\ 2 \end{pmatrix}$ Hence Q = (10, 3, -2)</p> <p>b) $\vec{SP} = \begin{pmatrix} 0 \\ -4 \\ 8 \end{pmatrix}$ $\vec{SP} = 4\sqrt{5}$, $\vec{SR} = \begin{pmatrix} 2 \\ 2 \\ 1 \end{pmatrix}$ $\vec{SR} = 3$</p> $\cos \text{PRS} = \frac{0 \times 2 + -4 \times 2 + 8 \times 1}{4\sqrt{5} \times 3} = \frac{0}{4\sqrt{5} \times 3}$ <p>$\cos \text{PRS} = 0$, so PRS is a right angle</p>	2 3	
2	$f(g(x)) = f(x^2 + 2)$ $= (x^2 + 2)^2 - 1$ $= x^4 + 2x^2 + 2x^2 + 4 - 1$ $= x^4 + 4x^2 + 3$	3	
3	<p>$\cos 2a = 1 - 2\sin^2 a$ or similar</p> $\cos 2a = 1 - 2\sin^2 a$ $= 1 - 2\left(\frac{3}{\sqrt{34}}\right)^2$ $= \frac{8}{17}$		3
4	<p>(i) $y = f(x - 2)$ (0,0) maps to (2,0) (2,-4) maps to (4,-4) (4,0) maps to (6,0)</p> <p>(ii) $y = 1 - f(x - 2)$ (2,0) maps to (2,1) (4,-4) maps to (4,5) (6,0) maps to (6,1)</p> <p>Annotate all three points on both graphs</p>	4	

5	<p>a) $\frac{1}{3} - \frac{1}{4} = \frac{4}{12} - \frac{3}{12} = \frac{1}{12}$</p> <p>b) $\cos \frac{\pi}{12} = \cos \left(\frac{\pi}{3} - \frac{\pi}{4} \right) = \cos \frac{\pi}{3} \cos \frac{\pi}{4} + \sin \frac{\pi}{3} \sin \frac{\pi}{4}$</p> $= \frac{1}{2} \times \frac{1}{\sqrt{2}} + \frac{\sqrt{3}}{2} \times \frac{1}{\sqrt{2}}$ $= \frac{1 + \sqrt{3}}{2\sqrt{2}}$	1 3
6	$\vec{PR} = \begin{pmatrix} 6 \\ 3 \\ -3 \end{pmatrix} \quad \mathbf{q} = \mathbf{p} + \frac{2}{3} \vec{PR} \quad \mathbf{q} = \begin{pmatrix} 3 \\ 1 \\ -2 \end{pmatrix} \quad Q = (5, 1, -2)$	3
7	$\log_3 \frac{x^2 - 4}{x - 2} = 3 \rightarrow \frac{x^2 - 4}{x - 2} = 27 \rightarrow \frac{(x+2)(x-2)}{(x-2)} = x+2 \rightarrow x+2 = 27, x = 25$	5
8	$2 = 1e^{k1.5}$ $2 = e^{1.5k}$ $\log_e(2) = 1.5k$ $\frac{\log_e(2)}{1.5} = k$ $k = 0.462$	3
30 marks		