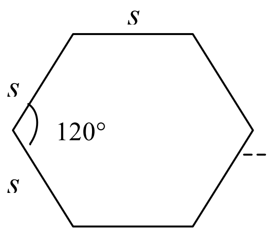
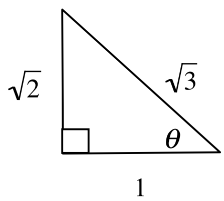
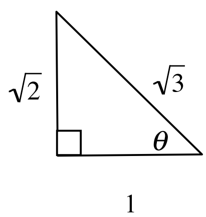
Assessment Schedule – 2008

Scholarship Mathematics with Calculus (93202)

Evidence Statement

For up to a maximum of 4 question parts a single minor error in that part may be accepted without loss of marks.

Question	Evidence	Code	Judgement
ONE (a)	 Using 6 equilateral triangles: Area $= 6\times\frac{1}{2}s^2\sin 60°$ $= 3s^2\sin 60°$ $= \frac{3\sqrt{3}}{2}s^2$ **OR** With two triangles and a rectangle: Area $= 2\times\frac{1}{2}s^2\sin 120° + 2s^2\sin 60°$ $= 3s^2\sin 60°$ $= \frac{3\sqrt{3}}{2}s^2$ Total area of the hexagonal stack $= 16\times\frac{3\sqrt{3}}{2}s^2$ $= 24\sqrt{3}s^2$	**2** **1** **1**	
ONE (b)	$A = 6hs + \frac{3}{2}s^2\left(\frac{-\cos\theta}{\sin\theta} + \frac{\sqrt{3}}{\sin\theta}\right) = 6hs + \frac{3}{2}s^2\left(-\cot\theta + \sqrt{3}\operatorname{cosec}\theta\right)$ So $\frac{\mathrm{d}A}{\mathrm{d}\theta} = \frac{3}{2}s^2\left(\operatorname{cosec}^2\theta - \sqrt{3}\operatorname{cosec}\theta\cot\theta\right)$ and for max/min $\frac{3}{2}s^2\left(\operatorname{cosec}^2\theta - \sqrt{3}\operatorname{cosec}\theta\cot\theta\right) = 0$ $\operatorname{cosec}\theta\left(\operatorname{cosec}\theta - \sqrt{3}\cot\theta\right) = 0$ $\operatorname{cosec}^2\theta\left(1 - \sqrt{3}\cos\theta\right) = 0$  But $\operatorname{cosec}^2\theta \neq 0$ so $1 - \sqrt{3}\cos\theta = 0$ $\cos\theta = \frac{1}{\sqrt{3}}$ **OR** $A = 6hs + \frac{3}{2}s^2\left(\frac{-\cos\theta}{\sin\theta} + \frac{\sqrt{3}}{\sin\theta}\right)$ $\frac{\mathrm{d}A}{\mathrm{d}\theta} = \frac{3}{2}s^2\left(\frac{\sin\theta(\sin\theta) - \left(-\cos\theta + \sqrt{3}\right)\cos\theta}{\sin^2\theta}\right)$	**3** **1** **2** **1**	

	$= \frac{3}{2}s^2\left(\frac{\sin^2\theta + \cos^2\theta - \sqrt{3}\cos\theta}{\sin^2\theta}\right)$	1	
	$= \frac{3}{2}s^2\left(\frac{1-\sqrt{3}\cos\theta}{\sin^2\theta}\right) = 0$ for max and min	2	
	$1-\sqrt{3}\cos\theta = 0$ $\cos\theta = \frac{1}{\sqrt{3}}$ Hence, surface area is a minimum at $\theta = \cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ $(= 0.9553 \text{ radians})$ $(= 54.7^\circ)$		
ONE (c)	$\frac{ds}{dt} = k\sin\theta$ $\quad$ $k\sin\frac{\pi}{4} = \sqrt{2}$ $k = 2$	3 1	Both needed
	$A = 6hs + \frac{3}{2}s^2\left(-\cot\theta + \sqrt{3}\operatorname{cosec}\theta\right)$ $\frac{dA}{dt} = 6h\frac{ds}{dt} + \frac{3}{2}2s\frac{ds}{dt}\left(-\cot\theta + \sqrt{3}\operatorname{cosec}\theta\right) + \frac{3}{2}s^2\left(\operatorname{cosec}^2\theta - \sqrt{3}\operatorname{cosec}\theta\cot\theta\right)\frac{d\theta}{dt}$ $= 2\sin\theta\left(6h + 3s\left(-\cot\theta + \sqrt{3}\operatorname{cosec}\theta\right)\right) + \frac{3}{2}s^2\operatorname{cosec}\theta\frac{d\theta}{dt}\left(\operatorname{cosec}\theta - \sqrt{3}\cot\theta\right)$	2	
	$= \frac{2\sqrt{2}}{\sqrt{3}}\left(6h + 3s\left(-\frac{1}{\sqrt{2}} + \sqrt{3}\frac{\sqrt{3}}{\sqrt{2}}\right)\right) + \frac{3}{2}s^2\sqrt{\frac{3}{2}}\frac{d\theta}{dt}\left(\sqrt{\frac{3}{2}} - \sqrt{3}\frac{1}{\sqrt{2}}\right)$ $= \frac{2\sqrt{2}}{\sqrt{3}}\left(6h + 3s\frac{2}{\sqrt{2}}\right)$ $= 4\left(\sqrt{6}h + \sqrt{3}s\right)$ (increasing, –sign not needed) 		Or equivalent

<table>
<tr><td>TWO
(a)</td><td>$\left(z+1\right)^3 = 8$ so $\left(\frac{z+1}{2}\right)^3 = 1$ and $\frac{z+1}{2} = 1, w, w^2$

$z = 1,\ 2w-1,\ 2w^2-1$</td><td>2</td><td>Or
$1, \text{cis}\left(\frac{2\pi}{3}\right), \text{cis}\left(\frac{4\pi}{3}\right)$
etc</td></tr>
<tr><td></td><td>and the sum of the roots is $1+2w-1+2w^2-1 = 2(1+w+w^2)-3 = -3$.

OR
$\left(z+1\right)^3 = 8$ so $z^3+3z^2+3z+1=8$ and $z^3+3z^2+3z-7=0$</td><td>1</td><td>Accept any 3 correct solutions, including those with no w’s</td></tr>
<tr><td></td><td>the sum of the roots is $-\frac{b}{a} = -3$.

OR
$z^3+3z^2+3z-7=0$ so $\left(z-1\right)\left(z^2+4z+7\right)=0$,

$z = 1, -2-\mathrm{i}\sqrt{3}, -2+\mathrm{i}\sqrt{3}$ (from quadratic formula)
OR
$\left(z+1\right)^3 = 8$ so $z+1 = 2\text{cis}\left(\frac{2k\pi}{3}\right)$, $k = 0,1,2$

$z+1 = 2,\ 2\left(-\frac{1}{2} \pm \frac{\sqrt{3}}{2}\mathrm{i}\right)$

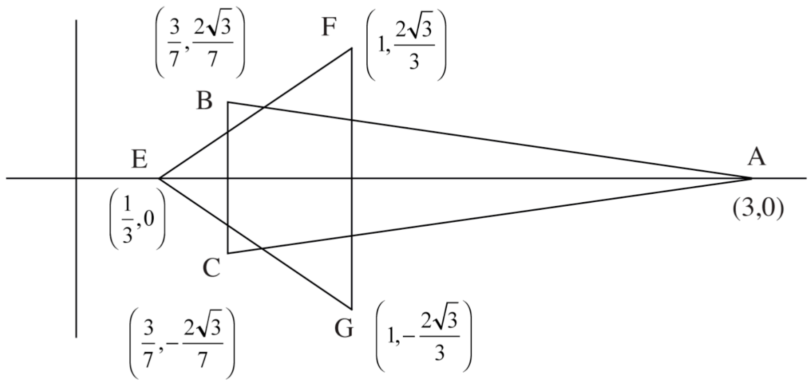
$z = 1,\ -2 \pm \sqrt{3}\mathrm{i}$</td><td>1</td><td></td></tr>
<tr><td>TWO
(b)</td><td>$\left(z+1\right)^3 = 8\left(z-1\right)^3$ so
$z^3+3z^2+3z+1 = 8\left(z^3-3z^2+3z-1\right)$
$7z^3-27z^2+21z-9=0$</td><td>3</td><td></td></tr>
<tr><td></td><td>by inspection $z = 3$, (or from $z+1 = 2\left(z-1\right)$) so

$\left(z-3\right)\left(7z^2-6z+3\right)=0$</td><td>1</td><td></td></tr>
<tr><td></td><td>and $z = 3, \frac{3-2\sqrt{3}\mathrm{i}}{7}, \frac{3+2\sqrt{3}\mathrm{i}}{7}$.
OR
$\left(\frac{z+1}{2\left(z-1\right)}\right)^3 = 1$ and $\frac{z+1}{2\left(z-1\right)} = 1, w, w^2$

$z+1 = 2z-2,\ z=3$
or
$z+1 = 2wz-2w,\ z = \frac{2w+1}{2w-1}$</td><td>2</td><td>Giving A, B, C
Accept in decimals $z = .429 \pm .495\mathrm{i}$ or equivalent</td></tr>
<tr><td></td><td>since $w = -\frac{1}{2}+\frac{\sqrt{3}}{2}\mathrm{i}$ [or $w = -\frac{1}{2}-\frac{\sqrt{3}}{2}\mathrm{i}$]</td><td>1</td><td></td></tr>
</table>

	$z=\frac{2w+1}{2w-1}=\frac{-1+\sqrt{3}\mathrm{i}+1}{-1+\sqrt{3}\mathrm{i}-1}=\frac{\sqrt{3}\mathrm{i}}{-2+\sqrt{3}\mathrm{i}}$	2	
	$=\frac{\sqrt{3}\mathrm{i}\left(-2-\sqrt{3}\mathrm{i}\right)}{\left(-2+\sqrt{3}\mathrm{i}\right)\left(-2-\sqrt{3}\mathrm{i}\right)}$ $=\frac{3-2\sqrt{3}\mathrm{i}}{7}$. Hence the other root is the conjugate $=\frac{3+2\sqrt{3}\mathrm{i}}{7}$. The solution is $z=3,\ \frac{3-2\sqrt{3}\mathrm{i}}{7},\ \frac{3+2\sqrt{3}\mathrm{i}}{7}$. [or use $z+1=2w^2z-2w^2,\ z=\frac{2w^2+1}{2w^2-1}$, although this is not needed with the above] **OR** $\left(z+1\right)^3=8\left(z-1\right)^3$ so $\frac{z+1}{z-1}=2\mathrm{cis}\left(\frac{2k\pi}{3}\right),\quad k=0,1,2$	1	
	$1+\frac{2}{z-1}=2\mathrm{cis}\left(\frac{2k\pi}{3}\right),\quad k=0,1,2$ and $1+\frac{2}{z-1}=2,\ 2\left(-\frac{1}{2}\pm\frac{\sqrt{3}}{2}\mathrm{i}\right)=2,\ -1\pm\sqrt{3}\mathrm{i}$ $\frac{2}{z-1}=1,\ -2\pm\sqrt{3}\mathrm{i}$ $z-1=2,\ \frac{2}{-2\pm\sqrt{3}\mathrm{i}}$	2	
	$z-1=2,\ \frac{2\left(-2\mp\sqrt{3}\mathrm{i}\right)}{7}$ $z=3,\ \frac{3\mp2\sqrt{3}\mathrm{i}}{7}$		

TWO (c)	For $\left(\frac{1}{z}+1\right)^3 = 8\left(\frac{1}{z}-1\right)^3$ this is part (ii) with the transformation $z=\frac{1}{u}$ where z is the solution to part (ii) and u the solution here, and so $u=\frac{1}{z}$. **Either** However, when $z = r\text{cis}\theta,\ \frac{1}{z}=\frac{1}{r}\text{cis}(-\theta)$, since $\frac{1}{z}=\frac{1}{r\text{cis}(\theta)}=\frac{\text{cis}(-\theta)}{r\text{cis}(\theta)\text{cis}(-\theta)}=\frac{\text{cis}(-\theta)}{r(c^2+s^2)}=\frac{1}{r}\text{cis}(-\theta)$ or $\frac{1}{r}$ times the solution to (b) and since $r=\frac{\sqrt{21}}{7}=\sqrt{\frac{3}{7}},\ \frac{1}{r}=\sqrt{\frac{7}{3}}$ and the (b) solutions are $\sqrt{\frac{3}{7}}\left(\sqrt{\frac{3}{7}}\pm\frac{2}{\sqrt{7}}\text{i}\right)$ Hence the three solutions are $z=\frac{1}{3},\ \sqrt{\frac{7}{3}}\left(\sqrt{\frac{3}{7}}\pm\frac{2}{\sqrt{7}}\text{i}\right)$	3	Accept unsimplified here
	$=\frac{1}{3},\ 1\pm\frac{2}{\sqrt{3}}\text{i}.$ **OR** $z=\frac{1}{3},\ \frac{7}{3-2\sqrt{3}\text{i}},\ \frac{7}{3+2\sqrt{3}\text{i}}=\frac{1}{3},\ \frac{7\left(3+2\sqrt{3}\text{i}\right)}{9+12},\ \frac{7\left(3-2\sqrt{3}\text{i}\right)}{9+12}$ $=\frac{1}{3},\ \frac{3\pm2\sqrt{3}\text{i}}{3}=1\pm\frac{2\sqrt{3}\text{i}}{3}.$ **OR** $u=\frac{1}{z}=\frac{2w-1}{2w+1}\ \frac{-2+\sqrt{3}\text{i}}{\text{i}\sqrt{3}}=\frac{-3-2\text{i}\sqrt{3}}{-3}$ and the other complex root is the conjugate $=\frac{3-2\text{i}\sqrt{3}}{3}$. The solutions are $z=\frac{1}{3},\ 1-\frac{2\text{i}\sqrt{3}}{3}, 1+\frac{2\text{i}\sqrt{3}}{3}$.	1	Or equivalent Giving E, F, G
	OR Replacing z with $\frac{1}{z}$ in $7z^3-27z^2+21z-9=0$ and multiplying through by z^3. $7-27z+21z^2-9z^3=0$ and use $9z^3-21z^2+27z-7=0$ $(3z-1)(3z^2-6z+7)=0$, and use quadratic formula.	1	



Ratio of areas $\dfrac{\Delta ABC}{\Delta EFG} = \dfrac{\frac{1}{2}\cdot\frac{4\sqrt{3}}{7}\cdot\frac{18}{7}}{\frac{1}{2}\cdot\frac{4\sqrt{3}}{3}\cdot\frac{2}{3}} = \dfrac{9\cdot 18}{2\cdot 49} = \dfrac{81}{49}$. [$ABC = \dfrac{36\sqrt{3}}{49}$, $EFG = \dfrac{4\sqrt{3}}{9}$]

	(see above)	**1**	For the diagram (infer with a correct answer)

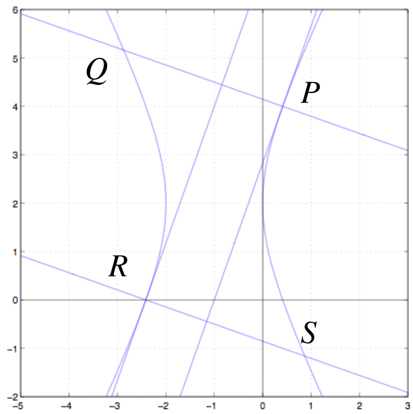
THREE (a)	$\frac{A}{x}+\frac{B}{P-x}=\frac{A(P-x)+Bx}{x(P-x)}$ so $\frac{A(P-x)+Bx}{x(P-x)}=\frac{1}{x(P-x)}$ Hence	**2**	
	$\Rightarrow -A+B=0 \Rightarrow A=B$ and $AP=1 \Rightarrow A=B=\frac{1}{P}$	**1**	For LHS above
THREE (b)	$\frac{\mathrm{d}N}{\mathrm{d}t}=kN(P-N)$ $\int \frac{\mathrm{d}N}{N(P-N)}=\int k\mathrm{d}t$ $\frac{1}{P}\int\left(\frac{1}{N}+\frac{1}{P-N}\right)\mathrm{d}N=kt+C$	**3**	Missing k maximum 2
	$\left[\ln\lvert N\rvert-\ln\lvert P-N\rvert\right]=Pkt+PC$ $\ln\left\lvert\frac{N}{P-N}\right\rvert=Pkt+PC$	**1**	
	$\frac{N}{P-N}=\mathrm{e}^{Pkt+PC}=M\mathrm{e}^{Pkt} \quad (1)$ $N\left(1+M\mathrm{e}^{Pkt}\right)=MP\mathrm{e}^{Pkt}$ $N=\frac{MP\mathrm{e}^{Pkt}}{1+M\mathrm{e}^{Pkt}}$	**2**	
THREE (c)	$t=0, \quad N=0.005P$ $\Rightarrow 0.005P=\frac{MP}{1+M}$ $\Rightarrow 0.005=0.995M$ $\Rightarrow M=\frac{0.005}{0.995}=\frac{1}{199}$	**3**	
	OR Using equation (1) $\frac{N}{P-N}=M\mathrm{e}^{Pkt}$ $\frac{\frac{1}{200}P}{P-\frac{1}{200}P}=M\mathrm{e}^{\circ}=M$ $M=\frac{\frac{1}{200}P}{\frac{199}{200}P}=\frac{1}{199}$ $\frac{\mathrm{d}N}{\mathrm{d}t}=0.08P=k\times\frac{P}{5}\times\frac{4P}{5}\Rightarrow k=\frac{1}{2P}$	**1**	Accept in decimals 3sf
	and **Either** Using (1)	**1**	For M or k

	$\dfrac{\frac{1}{2}P}{P-\frac{1}{2}P} = Me^{P\frac{1}{2P}t} = Me^{\frac{t}{2}}$ $\dfrac{\frac{1}{2}P}{P-\frac{1}{2}P} = \dfrac{1}{199}e^{\frac{t}{2}}$	**2**	
	$1 = \dfrac{1}{199}e^{\frac{t}{2}}$ $\dfrac{t}{2} = \ln(199), \quad t = 2\ln(199) = 10.586, \text{ or 11 days}$ **OR** $N = \dfrac{\frac{1}{199}Pe^{P\times\frac{1}{2P}t}}{1+\frac{1}{199}e^{P\times\frac{1}{2P}t}} = 0.5P$ $\Rightarrow \dfrac{e^{0.5t}}{199+e^{0.5t}} = 0.5$	**2**	
	$\Rightarrow 0.5e^{0.5t} = 199\times 0.5$ $\Rightarrow e^{0.5t} = 199$ $t = 10.586$ days, ie 11 days		

FOUR (a)	$h(x)=\left[f(x)\right]^{g(x)}$ $\ln\left[h\left(x\right)\right]=g(x)\ln\left[f(x)\right]$ $\dfrac{h'(x)}{h(x)}=g'(x)\ln\left[f(x)\right]+g(x)\dfrac{f'(x)}{f(x)}$	**2**	
	$h'(x)=h(x)\left[g'(x)\ln\left[f(x)\right]+g(x)\dfrac{f'(x)}{f(x)}\right]$ $=\left[f(x)\right]^{g(x)}\left[g'(x)\ln\left[f(x)\right]+g(x)\dfrac{f'(x)}{f(x)}\right]$ **OR** $h(x)=e^{\ln\left(\left[f(x)\right]^{g(x)}\right)}=e^{g(x)\ln\left[f(x)\right]}$ $h'(x)==e^{g(x)\ln\left[f(x)\right]}\left(g'(x)\ln\left[f(x)\right]+g(x)\dfrac{f'(x)}{f(x)}\right)$ $h'(x)=\left[f(x)\right]^{g(x)}\left[g'(x)\ln\left[f(x)\right]+g(x)\dfrac{f'(x)}{f(x)}\right]$	**1**	Do not allow only $h'(x)$ on LHS
FOUR (b)	$p(x)=x\ln(\ln x)$ $p'(x)=x\dfrac{\frac{1}{x}}{\ln x}+\ln(\ln x)$ $=\dfrac{1}{\ln x}+\ln(\ln x)$	**3**	
	If $f(x)=\ln x$ then $f'(x)=\dfrac{1}{x}$ and $g(x)=x$ then $g'(x)=1$ So $h'(x)=\left(\ln x\right)^{x}\left[g'(x)\ln\left[f(x)\right]+g(x)\dfrac{f'(x)}{f(x)}\right]=\left(\ln x\right)^{x}\left(1\times\ln(\ln x)+x\times\dfrac{1}{x}\times\dfrac{1}{\ln x}\right)$ $=\left(\ln x\right)^{x}\left(\ln(\ln x)+\dfrac{1}{\ln x}\right)$	**1**	
	Hence $\int\left(\ln x\right)^{x}p'(x)\mathrm{d}x=\int\left(\ln x\right)^{x}\left[\ln(\ln x)+\dfrac{1}{\ln x}\right]\mathrm{d}x$ $=\int h'(x)dx=\left(\ln x\right)^{x}+C$ **OR** $p(x)=\ln(\ln x)^{x}$ $e^{p(x)}=(\ln x)^{x}$ but $\dfrac{d\left(e^{p(x)}\right)}{dx}=p'(x)e^{p(x)}$ So $\int p'(x)e^{p(x)}\mathrm{d}x=e^{p(x)}+C$ and $\int\left(\ln x\right)^{x}p'(x)\mathrm{d}x=e^{p(x)}+C=\left(\ln x\right)^{x}+C$	**2**	$+C$ required

FOUR (c)	$g(x) = -(2x-a)^4 + bx + c$ For a factor $x-1$, $g(1) = -(2-a)^4 + b + c = 0$ or $b + c = (2-a)^4$	3	
	$-(2x-1)^4 + 8x - 7 = 0$ so $a = 1,\ b = 8,\ c = -7$ $b + c = 1$ and $(2-a)^4 = 1$ so $x-1$ is a factor. $-(2x-1)^4 + 8x - 7 = (x-1)(fx^3 + gx^2 + hx + j)$ $-16x^4 + 32x^3 - 24x^2 + 8x - 1 + 8x - 7 = (x-1)(fx^3 + gx^2 + hx + j)$	1	Or equivalent
	$-16x^4 + 32x^3 - 24x^2 + 16x - 8 = (x-1)(fx^3 + gx^2 + hx + j)$ and comparing coefficients $f = -16,\ j = 8,\ -h + j = 16,\ h = -8,\ -g + h = -24,\ g = 16.$ $-(2x-1)^4 + 8x - 7 = (x-1)(-16x^3 + 16x^2 - 8x + 8)$ $= 8(x-1)(-2x^3 + 2x^2 - x + 1) = 8(x-1)(x-1)(-2x^2 - 1)$ $-8(x-1)^2(2x^2 + 1)$ So for $-(2x-1)^4 + 8x - 7 = 0$, $-8(x-1)^2(2x^2 + 1) = 0$ $x = 1$ (twice) or $x = \pm\sqrt{\frac{-1}{2}} = \pm\frac{\sqrt{2}}{2}\text{i}$	2	For $x-1$ and expansion (independent marks) OR using long division

FIVE (a)	$x = \sec\theta - 1$, $y = 2\tan\theta + 2$ Since $\sec^2\theta = 1 + \tan^2\theta$ $(1+x)^2 = 1 + \left(\dfrac{y-2}{2}\right)^2$ $(y-2)^2 = 4(1+x)^2 - 4$	**2**	1 only for wrong signs. Or equivalent Accept $y = \pm 2\sqrt{(x^2+2x)} + 2$
FIVE (b)	**Either** $\dfrac{dy}{dx} = \dfrac{dy/d\theta}{dx/d\theta} = \dfrac{2\sec^2\theta}{\sec\theta\tan\theta} = \dfrac{2\sec\theta}{\tan\theta}$ so the gradient of the normal is $-\dfrac{\tan\theta}{2\sec\theta} = -\dfrac{\sin\theta}{2}$. When $\theta = \dfrac{\pi}{4}$, $-\dfrac{\sin\theta}{2} = -\dfrac{1}{2\sqrt{2}}$.	**3** **1**	
	Or $(y-2)^2 = 4(1+x)^2 - 4$ so $2(y-2)\dfrac{dy}{dx} = 8(1+x)$ $\dfrac{dy}{dx} = \dfrac{4(1+x)}{y-2}$ and at $x = (\sqrt{2}-1, 4)$ $\dfrac{dy}{dx} = \dfrac{4\sqrt{2}}{2} = 2\sqrt{2}$ So the gradient of the normal is $-\dfrac{1}{2\sqrt{2}}$.	**1**	
	Equation of the normal at $\theta = \dfrac{\pi}{4}$, $y - (2+2) = -\dfrac{1}{2\sqrt{2}}(x - \sqrt{2} + 1)$ $y - 4 = -\dfrac{1}{2\sqrt{2}}(x - \sqrt{2} + 1)$	**2**	Or equivalent
	$(x+1) = -2\sqrt{2}(y-4) + \sqrt{2}$ So this meets the curve again where $\left(-2\sqrt{2}(y-4) + \sqrt{2}\right)^2 = \dfrac{(y-2)^2 + 4}{4}$ $4\left(-2\sqrt{2}y + 9\sqrt{2}\right)^2 = (y-2)^2 + 4$ $4(8y^2 - 72y + 162) = y^2 - 4y + 8$ $31y^2 - 284y + 640 = 0$ but $y = 4$ is a solution, so $(y-4)(31y-160) = 0$ and $y = \dfrac{160}{31}$, $a = 160$, $b = 31$		Accept implicit *a, b,* but exact answer only.

FIVE (c)	 R is the point where $\theta = \frac{3\pi}{4}$ $x = -\sqrt{2} - 1,\ \ y = 0$	**3**	
	EITHER **Either** QR is parallel to PS, so by symmetry the y coordinate of S is given by: $y - 4 = 0 - \frac{160}{31}$	**1**	For coordinates of R
	$y = \frac{124 - 160}{31} = -\frac{36}{31}$. **Or** Equation of normal through R is $y - 0 = -\frac{1}{2\sqrt{2}}\left(x + \sqrt{2} + 1\right)$ and this meets the curve again where $\left(-2\sqrt{2}y - \sqrt{2}\right)^2 = \frac{(y-2)^2 + 4}{4}$	**2**	For correct use of similar triangles, etc
	$8(-2y-1)^2 = (y-2)^2 + 4$ $8\left(4y^2 + 4y + 1\right) = y^2 - 4y + 8$ $31y^2 + 36y = 0$ $y = 0$ or $y = -\frac{36}{31}$ but $y = 0$ at R and so $y = -\frac{36}{31}$. **OR** By symmetry S can be obtained by rotating Q through 180° about the centre of the hyperbola, (–1, 2). Hence, by similar triangles $\frac{160}{31} - 2 = 2 - y$ and so $y = 4 - \frac{160}{31} = \frac{124 - 160}{31} = -\frac{36}{31}$.	**2**	Or equivalent substitution Exact answer required, not decimals.