	Give 1 mark for each •	Illustration(s) for awarding each mark
1.	**ans: (–1, 4) (5 marks)**	**Pegasys Extension test 2013-14 Q8**
	•1 substitutes for y	•1 $x^2+(3-x)^2-2x-12(3-x)+29=0$
	•2 expands brackets and simplifies	•2 $2x^2+4x+2=0$
	•3 factorises	•3 $2(x+1)(x+1)=0$
	•4 proves tangency	•4 $x=-1$(twice) [or $b^2-4ac=0$]
	•5 finds y – coord and states coordinates	•5 $y=3-(-1)=4$; (–1, 4)
2	**ans: $\frac{\pi}{6};\frac{5\pi}{6}$ (6 marks)**	**Pegasys Extension test**
	•1 multiplies brackets and substitutes	•1 $2(1-2\sin^2 x)+8\sin x-5=0$
	•2 simplifies to quadratic in sin x	•2 $4\sin^2 x-8\sin x+3=0$
	•3 factorises	•3 $(2\sin x-1)(2\sin x-3)=0$
	•4 solves and discards	•4 $\sin x=\frac{1}{2}$ or $\sin x=\frac{3}{2}$ (discard)
	•5 and •6 finds angles	•5 and •6 $x=\frac{\pi}{6};\frac{5\pi}{6}$
3(a)	**ans: 1331 (2 marks)**	
	•1 calculation	•1 Low High $U_1=0\cdot75(2100)=1575+200 \quad =1775$ $U_2=0\cdot75(1775)=1331\cdot25$
	•2 answer	•2 1331 (don't penalise rounding)
(b)	**ans:** Colony is in danger with explanation **(4 marks)**	
	•1 knows to calculate limit + knows formula	•1 $L=\frac{b}{1-a}$
	•2 calculates limit correctly	•2 $L=\frac{200}{1-0\cdot75}=800$
	•3 knows to subtract 200	•3 low population 800 - 200 = 600
	•4 explanation	•4 600 prior to breeding week is less than 700 bats so colony in danger

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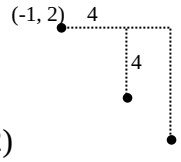
4	**ans:** $\frac{5}{2}x^{\frac{3}{2}}+\frac{3}{2}x^{-\frac{3}{2}}$ **(4 marks)**	**Pegasys Higher Extension Test 2012-13 Q11**
	•[1] prepares to differentiate first term	•[1] $y=x^{\frac{5}{2}}$
	•[3] prepares to differentiate first term	•[2] $y=-3x^{-\frac{1}{2}}$
	•[4] differentiates first term	•[3] $\frac{dy}{dx}=\frac{5}{2}x^{\frac{3}{2}}$.....
	•[4] differentiates second term	•[4] .....$\frac{3}{2}x^{-\frac{3}{2}}$
5(a)	**ans: A(3, 7), B(5, 7)** **(4 marks)**	**Pegasys Extension Test 2010/11 Q9**
	•[1] equates lines	•[1] $2+6x-x^2=x^2-4x+2$
	•[2] rearranges and factorises	•[2] $2x^2-10x=0$ and $2x(x-5)=0$
	•[3] solves for x	•[3] x = 0 or 5
	•[4] finds coordinates of A and B	•[3] A(0, 2) , B(5, 7)
5(b)	**ans** $41\frac{2}{3}$ **sq units** **(4 marks)**	
	•[1] sets up integration and simplifies	•[1] $\int_0^5(10x-2x^2)dx$
	•[2] integrates	•[2] $\left[5x^2-\frac{2x^3}{3}\right]_0^5$
	•[3] substitutes	•[3] $[5\times25-\frac{2}{3}\times125]-[0]$
	•[4] evaluates	•[4] $41\frac{2}{3}$
6 (a)	**ans: proof and (3, -2)** **(6 marks)**	**Pegasys Extension Test 2005/6 Q1**
	•[1] stating two centres	•[1] (-1, 2) and (6, -5)
	•[2] finding distance between centres	•[2] $\sqrt{(-1-6)^2+(2+5)^2}=7\sqrt{2}$
	•[3] calculating two radii	•[3] $4\sqrt{2}$ and $3\sqrt{2}$
	•[4] stating condition for touching circles	•[4] distance between centres = sum of radii
	•[5] stepping to find point of contact	•[5] 
	•[6] answer	•[6] (3, -2)
(b)	**ans: y = x – 5 (or equivalent)** **(3 marks)**	
	•[1] knows to find gradient of radius	•[1] $m_{rad}=\frac{2-(-2)}{-1-3}=\frac{4}{-4}=-1$
	•[2] knows $m_1\times m_2=-1$	•[2] $m_{\tan}=1(1,2)$
	•[3] sub into $y-b=m(x-a)$ and rearrange	•[3] $y+2=x-3$

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7a.	**ans:** $a = 2 \;\; b = 3 \;\; c = 1$ **(3 marks)**	
	•1 interpret vertical scaling •2 interpret period •3 interpret vertical translation	•1 $a = 2$ •2 $b = 3$; •3 $c = 1$
7b.	**ans:** $x_P = 50^\circ$ **(3 marks)**	
	•1 set to zero •2 process exact value •3 interpret diagram	•1 $2\sin 3x - 1 = 0$ •2 one answer from 10^0 or 50^0 •3 $x_P = 50^\circ$
8.	**ans:** $y = 2x^2 - 2x^3 + 5$ **(4 marks)**	
	•1 knows to integrate and prepares •2 integrates •3 subs values •4 finds C and states y in terms of x	•1 $y = \int$ ..... stated or implied by •2 •2 $2x^2 - 2x^3$ •3 $9 = 2(-1)^2 - 2(-1)^3 + C$ •4 $C = 5$; $y = 2x^2 - 2x^3 + 5$
9(a)	**ans: A(4, 32)** **(4 marks)**	
	•1 finds derivative and equates to zero •2 solves for x •3 chooses appropriate value and subs •4 states coordinates of A	•1 $\frac{dy}{dx} = 12x - 3x^2 = 0$ •2 $3x(4 - x) = 0; x = 0; 4$ •3 when $x = 4$, $y = 6(4^2) - 4^3 = 32$ •4 A(4, 32)
(b)	**ans: (– 1, 7)** **(5 marks)**	
	•1 establishes equation of AB •2 equates equations of line and curve •3 knows to use synthetic division •4 solves and chooses solution •5 subs and states coordinates of B	•1 $y - 32 = 5(x - 4)$; $y = 5x + 12$ •2 $5x + 12 = 6x^2 - x^3$; $x^3 - 6x^2 + 5x + 12 =$ •3 $\begin{array}{c\|cccc} 4 & 1 & -6 & 5 & 12 \\ & & 4 & -8 & -12 \\ \hline & 1 & -2 & -3 & 0 \end{array}$ •4 $(x - 4)(x - 3)(x + 1) = 0$; $x = -1$ •5 $y = 5(-1) + 12 = 7$

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10(a)	**ans: proof** **(3 marks)**	**Higher Still Notes Item Bank OB 03-015**
	•[1] identify base and height	•[1] $2x$ and $6-x^2$
	•[2] area = length x breadth	•[2] $A(x)=2x(6-x^2)$
	•[3] simplify	•[3] $A(x)=12x-2x^3$
(b)	**ans:** $8\sqrt{2}$ **(5 marks)**	
	•[1] know to solve $A'(x)=0$	•[1] at SPs $A'(x)=0$
	•[2] find $A'(x)$	•[2] $12-6x^2$
	•[3] solve	•[3] $x=\sqrt{2}$
	•[4] justify nature	•[4] $\begin{array}{c\|ccc} x & \to & \sqrt{2} & \to \\ \hline A'(x) & + & 0 & - \end{array}$
	•[5] find and state area	•[5] $A(\sqrt{2})=12\sqrt{2}-2(\sqrt{2})^3=8\sqrt{2}$
11	**ans:** $k=-7$ **(5 marks)**	**Higher Still Notes Item Bank Ex 2-1-8**
	•[1] equate	•[1] $2x^2+x-5=5x+k$
	•[2] express in standard form	•[2] $2x^2-4x-5-k=0$
	•[3] use discriminant	•[3] $b^2-4ac=0$
	•[4] evaluate discriminant	•[4] $16-4\times2\times(-5-k)=0$ $16+40+8k=0$
	•[5] find k	•[5] $8k=-56,\ k=-7$

Total 70