1	$6C4 \times [2(x)]^4 \times \left[\frac{1}{(x^2)}\right]^2$	B2		B1 for 2/3 terms correct
	240	B1	[3]	Identified as answer. Allow $240x^0$
2	$\frac{\delta y}{\delta x} = 9x^2 - 12x + 4$	M1A1		
	$(3x-2)^2 \geq 0$	A1	[3]	
3	**(i)** Correct cosine curve for at least 1 oscillation	B1		Range $-1 \to 1$. Ignore labels on θ axis
	Exactly 2 complete oscillations in $[0, 2\pi]$	B1		
	Line $y = \frac{1}{2}$ correct	B1	[3]	
	(ii) 4	B1√	[1]	Ft *their* graph. Accept $30°$, $150°$, $210°$, $330°$
	(iii) 20	B1√	[1]	Or $5 \times$ *their* part **(ii)**
4	**(i)** 3	B1	[1]	
	(ii) $f(x) = x^2 - 6x(+c)$	M1A1		Dependent on c present
	Subst $(3,-4)$	M1		cao
	$c = 5 \to f(x) = x^2 - 6x + 5$	A1	[4]	
5	**(i)** **Arc** $AB = r\theta$	M1		
	$OC = r\sin\theta$ or $BC = r\cos\theta$	M1		oe eg $BC = r\sin\frac{\theta}{\tan\theta}$ etc
	$r(1 + \theta + \cos\theta + \sin\theta)$ correctly derived	A1	[3]	OC & BC reversed loses M1A1
	(ii) Sector $OAB = \frac{1}{2} \times 10^2 \times \frac{\pi}{5}$ $(= 31.42)$	M1		oe Δ in terms of π and 10
	$\Delta OCB = \frac{1}{2\left(10\cos\frac{\pi}{5}\right)\left(10\sin\frac{\pi}{5}\right)}$ $(= 23.78)$	M1		Allow OC & BC reversed (ie max 4/6)
	Total area $= 55.2$	A1	[3]	
6	**(a)** $a + 5d = 23$	B1		Solution of 2 linear equations
	$5(2a + 9d) = 200$	B1		
	Attempt solution, expect $d = 6$ $a = -7$	M1		
	29	A1	[4]	

	(b) $\frac{1}{1-r}(=)\frac{4}{1-\frac{1}{4}r}$	M1		Use of S_∞ formula twice
	$r=\frac{4}{5}$ oe $S=5$	A1A1	[3]	
7	**(i)** $y=\frac{1}{6(48-8x)}$ oe	B1	[1]	
	(ii) $A=4xy+2xy$ or $3xy+3xy=6xy$	M1		
	$A=x(48-8x)=48x-8x^2$	A1	[2]	AG
	(iii) $\frac{\delta A}{\delta x}=48-16x$	B1		
	$A=72$ cao	M1A1		Attempt to solve derivative $=0$ Expect $x=3$
	$\frac{\delta^2 A}{\delta x^2}=-16 \quad (<0)\Rightarrow$ Maximum	B1	[4]	www Accept other complete methods
8	**(i)** $(4i+7j-pk).(8i-j-pk)=25+p^2$	M1A1	[2]	$x_1x_2+y_1y_2+z_1z_2$ (Not $25+(-p)^2$)
	(ii) $25+p^2=0\Rightarrow$ no real solutions	B1√	[1]	Ft provided equation has no real solutions
	(iii) $\cos 60=\frac{OA.OB}{\lvert OA\rvert\lvert OB\rvert}$ used	M1		$OA.OB$ must be scalar
	$\lvert OA\rvert=\sqrt{65+p^2}$ or $\lvert OB\rvert=\sqrt{65+p^2}$	M1		Not $\sqrt{65-p^2}$ unless follows $\sqrt{65+(-p)^2}$
	$\frac{25+p^2}{65+p^2}=\frac{1}{2}$ or $\frac{his\ scalar\ (i)}{65+p^2}=\frac{1}{2}$	A1√		Scalar product $=25+p^2$ can score here if not scored in part **(i)**
	$p=\pm 3.87$ or $\pm\sqrt{15}$	A1	[4]	
9	**(i)** $x^2+3x+4=2x+6\Rightarrow x^2+x-2(=0)$	M1		3-term simplification
	$(x-1)(x+2)=0\rightarrow(1,8),(-2,2)$	DM1A1		DM1 for attempted solution for x
	$AB=\sqrt{3^2+6^2}=6.71$ or $\sqrt{45}$ or $3\sqrt{5}$	B1		cao ($\sqrt{45}$ from wrong points scores B0)
	$\left(-\frac{1}{2},5\right)$	B1√	[5]	Ft *their* coordinates

	(ii) $x^2 + (3-k)x + 2k - 6 (= 0)$	M1		Simplified to 3-term quadratic
	$(3-k)^2 - 4(2k-6) = 0$	DM1		Apply $b^2 - 4ac = 0$ as function of k only
	$(3-k)(11-k) = 0$	DM1		Attempt factorisation or use formula Both correct
	$k = 3$ or 11	A1	[4]	NB Alternative methods for **(ii)** possible
10	**(i)** B $= (0,1)$ C $= (4,3)$	B1, B1	[2]	If B0B0 then SCB1 for both $y = 1$ & $x = 4$
	(ii) $\frac{\delta y}{\delta x} = \frac{1}{2} \times 2(1+2x)^{-\frac{1}{2}}$	M1A1		$-\frac{1}{2}$ required & at least one of $\frac{1}{2} \times 2$ for M1
	Grad. of normal $= -3$	B1		
	$y - 3 = -3(x-4)$ or $y = -3x + 15$ oe	B1√	[4]	Ft only from *their* C
	(iii) $y^2 = 1 + 2x \Rightarrow x = \frac{1}{2(y^2-1)}$ SOI	B1		$\int x^2 \delta y$, square $\frac{1}{2}(y^2-1)$ & attempt int^n
	$(\pi) \times \frac{1}{4} \times \int (y^4 - 2y^2 + 1) \delta y$	M1		
	$(\pi) \times \frac{1}{4}\left[\frac{y^5}{5} - \frac{2y^3}{3} + y\right]$	A1		Apply limits $0 \to$ *their* 1 (from *their* B)
	$(\pi) \times \frac{1}{4}\left[\frac{1}{5} - \frac{2}{3} + 1\right]$	DM1		cao SCB1 for $\int y^2 \delta x \to \frac{\pi}{4}$ (scores 1/5)
	$\frac{2}{15}\pi$	A1	[5]	
11	**(i)** $2(x-2)^2 + 2$	B 1, B1, B1	[3]	For 2, -2, 2
	(ii) $2 \le f(x) \le 10$ oe	B1	[1]	Allow $<$ etc. Ignore notation
	(iii) $2 \le x \le 10$	B1√	[1]	Ft from part **(ii)**. Ignore notation
	(iv) $f(x)$: ≈ half parabola from $(0,10)$ to $(2,2)$	B1		Or from int with y axis to int with *their* $y = x$
	$g(x)$: line through 0 at ≈ $45°$	B1		
	$f^{-1}(x)$: reflection of *their* $f(x)$ in $g(x)$	B1√		
	Everything totally correct	B1	[4]	

	(v) $(x-2)^2 = \frac{1}{2}(y-2)$	M1		Allow $+\sqrt{}$ or $-\sqrt{}$. Dep on final ans as f^n of x
	$x = 2 \pm \sqrt{\frac{1}{2}(y-2)}$	M1		
	$f^{-1}(x) = 2 - \sqrt{\frac{1}{2}(x-2)}$	A1	[3]	cao