1	${}^9C_6$ or ${}^9C_3$ used $\left(\frac{1}{x^2}\right)^3$ seen –84	M1 B1 A1	[3]	Correct answer only ⇒ 3marks
2	**(i)** (3½, 2)	B1	[1]	
	(ii) $m = \frac{-1-5}{5-2} = -2$	B1		
	$y - 6 = \frac{-1}{m}(x-8)$	M1		Use of $m_1m_2 = -1$ and $y - k = m(x - h)$
	$x - 2y + 4 = 0$	A1	[3]	Accept any form
3	$15\cos^2x + \cos x - 2 = 0$ $(5\cos x + 2)(3\cos x - 1) = 0$	M1 M1		$1 - \cos^2x = \sin^2x$ & attempt simplify Attempt to solve 3-term quadratic for cos$x$
	113(.6), 70.5	A1A1	[4]	SC 1.98, 1.23 scores 1/2
4	**(i)** Correct sine curve	B1	[1]	2 shown or implied
	(ii) Required line $y = 1 - \frac{x}{\pi}$	B1		
	Line through (0, 1), (π, 0) drawn	B1		SC B1 for correct graphs without 1 or 2 marked
	3 roots	B1√	[3]	ft on trig curve and line
5	**(i)** $\frac{dy}{dx} = \frac{-1}{(x-3)^2} + 1$	B1		oe
	$\frac{d^2y}{dx^2} = \frac{2}{(x-3)^3}$	B1	[2]	oe
	(ii) $(x-3)^2 = 1 \Rightarrow x - 3 = \pm 1$	M1		Set $\frac{dy}{dx} = 0$ & reasonable attempt to solve
	$x = 4, 2$ $y = 5, 1$	A1 A1		
	When $x = 4$ $\frac{d^2y}{dx^2} > 0 (= 2) \Rightarrow$ min	M1		Investigate signs of f″ at a point or other method
	When $x = 2$ $\frac{d^2y}{dx^2} < 0 (= -2) \Rightarrow$ max	A1	[5]	

6	**(i)** $(3x + 5)(x - 1)(> 0)$ $-5/3, 1$ $x < -5/3, x > 1$	M1 A1 A1	[3]	Attempt at factorisation Both required Ignore any words between answers Condone ‹ ›
	(ii) $f(x) = x^3 + x^2 - 5x\ (+ c)$ $3 = 1 + 1 - 5 + c$ $f(x) = x^3 + x^2 - 5x + 6$	M1 A1 M1 A1	[4]	Attempt at integration Any unsimplified expression ok Sub. (1, 3) Accept $c = 6$
7	**(i)** Range is $0 \leqslant f(x) \leqslant 4$, 0 to 4	B1	[1]	Accept in two parts. Condone <
	(ii) $y = x$ drawn or implied Correct sketch of f^{-1}	B1 B1	[2]	SC if f missing, (2, 2) (4, 6) must be shown
	(iii) $(x \mapsto)\sqrt{2x}$ for $0 \leqslant x \leqslant 2$ $(x \mapsto)2x - 2$ for $2 < x \leqslant 4$	B1B1 B1B1	[4]	Condone < ‹
8	**(i)** $1/2 \times 5^2 \times 1.2$ $1/2 \times 5^2 \times \sin 1.2$ $2[1/2 \times 5^2 \times 1.2 - 1/2 \times 5^2 \times \sin 1.2]$ 6.70	B1 B1 M1 A1	[4]	 Subtraction and multiplication by 2 Accept 6.7 or anything rounding to 6.70
	(ii) $5\cos 0.6$ $5 - \text{“}5\cos 0.6\text{”}$ $10(1 - \cos 0.6)$ 1.75	M1 M1 M1 A1	[4]	 Subtraction from 5 Multiplication by 2
9	**(a)** $\dfrac{100}{1-r} = 2000$ $r = 19/20$ $ar = 95$	M1 A1 A1√	[3]	Correct formula and attempt to solve For $100 \times r$
	(b) **(i)** $a + 2d = 90, a + 4d = 80$ $d = -5, a = 100$	B1B1	[2]	
	(ii) $a + md = 0$ $m = 20$	M1 A1	[2]	Or use correct sum formula $m = 20$ with no working scores 2
	(iii) $\dfrac{n}{2}[200 + (n-1)(-5)] = 0$ $n = 41$	M1 A1	[2]	 $n = 41$ with no working scores 2 Do not penalise $n = 0$

10	**(i)** $\overrightarrow{OA}.\overrightarrow{OB} = -6 + 2 + 12 = 8$	M1		Use of $x_1x_2 + y_1y_2 + z_1z_2$
	$\cos AOB = \dfrac{8}{\sqrt{14}\sqrt{29}}$	M1 M1		Mod worked correctly for either one Division of "8" by product of mods
	$AOB = 66.6°$	A1	[4]	
	(ii) $3\mathbf{i} - 2\mathbf{j} + 4\mathbf{k} + p(2\mathbf{i} + \mathbf{j} - 3\mathbf{k})$	B1	[1]	In any unsimplified form
	(iii) $\overrightarrow{BC} = \mathbf{i}(3 + 2p) + \mathbf{j}(-2 + p) + \mathbf{k}(4 - 3p)$	M1		
	Their $\overrightarrow{BC}.[2\mathbf{i} + \mathbf{j} - 3\mathbf{k}] = 0$	M1		Scalar product = 0 used
	$2(3 + 2p) + (p - 2) - 3(4 - 3p) = 0$	A1√		ft from their BC
	$p = 4/7$ 0.571	A1	[4]	cao
11	**(i)** $9 - x^3 = \dfrac{8}{x^3}$	M1		Together with attempt to mult by x^3
	$x^6 - 9x^3 + 8 = 0$	A1		**AG** completely correct working
	$(X - 1)(X - 8) = 0 \rightarrow X = 1$ or 8	M1		Attempt to solve quadratic in X or x^3
	$a = 1, b = 2$	A1	[4]	
	(ii) $\int_1^2 \left[\left(9 - x^3\right) - \dfrac{8}{x^3}\right] dx$	M1		Intention to integrate the difference $y_1 - y_2$ not $\pi(y_1 - y_2)$
	$\left[9x - \dfrac{x^4}{4}\right] \cdot \left[\dfrac{-4}{x^2}\right]$	B1 B1		
	$18 - 4 + 1 - (9 - \dfrac{1}{4} + 4)$	M1		Correct use of their limits once
	$2\dfrac{1}{4}$	A1	[5]	
	(iii) $\dfrac{dy}{dx} = \dfrac{-24}{x^4}$, $\dfrac{dy}{dx} = -3x^2$	B1, B1		cao
	$\dfrac{-24}{c^4} = -3c^2$			
	$c^6 = 8$	M1		Equating and solution
	$c = \sqrt{2}$ or $8^{1/6}$ or 1.41(4...)	A1	[4]	Accept x or c