1 (i)	$(x+3)^2-7$	**B1B1**	[2]	For $a = 3$, $b = -7$
(ii)	$1,-7$ seen $x>1$, $x<-7$ oe	**B1** **B1**	[2]	$x>1$ or $x<-7$ Allow $x\leqslant -7, x\geqslant 1$ oe
2	$8C6(2x)^6\left(\frac{1}{2x^3}\right)^2$ soi $28\times 64\times\frac{1}{4}$ oe (powers and factorials evaluated) 448	**B1** **B2,1,0** **B1**	[4]	May be seen within a number of terms May be seen within a number of terms Identified as answer
3 (i)	$2r\alpha + r\alpha + 2r = 4.4r$ $\alpha = 0.8$	**M1** **A1**	[2]	At least 3 of the 4 terms required
(ii)	$½(2r)^2\,0.8 - ½(r^2)0.8 = 30$ $(3/2)r^2\times 0.8 = 30 \;\rightarrow\; r = 5$	**M1A1**√ **A1**	[3]	Ft through on *their* α
4 (i)	$C = (4, -2)$ $m_{AB} = -1/2 \rightarrow m_{CD} = 2$ Equation of CD is $y+2 = 2(x-4)$ oe $y = 2x-10$	**B1** **M1** **M1** **A1**	[4]	Use of $m_1m_2 = -1$ on their m_{AB} Use of *their* C and m_{CD} in a line equation
(ii)	$AD^2 = (14-0)^2 + (-7-(-10))^2$ AD = 14.3 or √205	**M1** **A1**	[2]	Use *their* D in a correct method
5	$a(1+r) = 50$ or $\frac{a(1-r^2)}{1-r} = 50$ $ar(1+r) = 30$ or $\frac{a(1-r^3)}{1-r} = 30+a$ Eliminating a or r $r = 3/5$ $a = 125/4$ oe $S = 625/8$ oe	**B1** **B1** **M1** **A1** **A1** **A1**√	[6]	Or otherwise attempt to solve for r Any correct method Ft through on *their* r and a $(-1<r<1)$

6	(i)	$\cos^4 x = \left(1-\sin^2 x\right)^2 \quad = 1 - 2\sin^2 x + \sin^4 x$ AG	B1	[1]	Could be LHS to RHS or vice versa
	(ii)	$8\sin^4 x + 1 - 2\sin^2 x + \sin^4 x = 2\left(1-\sin^2 x\right)$ $9\sin^4 x = 1$ $x = 35.3^o$ (or any correct solution) Any correct second solution from 144.7°, 215.3°, 324.7° The remaining 2 solutions	M1 A1 A1 A1√ A1	[5]	Substitute for $\cos^4 x$ and $\cos^2 x$ or OR sub for $\sin^4 x \to 3\cos^2 x = 2$ $\to \cos x = (\pm)\sqrt{2/3}$ Allow the first 2 **A1** marks for radians (0.616, 2.53, 3.76, 5.67)
7	(i)	A = (½, 0)	B1	[1]	Accept $x = 0$ *at* $y = 0$
	(ii)	$\int (1-2x)^{\frac{1}{2}}\,dx \quad = \left[\dfrac{(1-2x)^{3/2}}{3/2}\right]\left[\div(-2)\right]$ $\int (2x-1)^2\,dx \quad = \left[\dfrac{(2x-1)^3}{3}\right]\left[\div 2\right]$ $\left[0-(-1/3)\right]-\left[0-(-1/6)\right]$ 1/6	B1B1 B1B1 M1 A1	[6]	May be seen in a single expression May use $\int_a^1 x\,dy$, may expand $(2x-1)^2$ Correct use of *their* limits
8	(i)	fg(x) = $5x$ Range of fg is $y \geqslant 0$ oe	M1A1 B1	[3]	only Accept $y > 0$
	(ii)	$y = 4/(5x+2) \Rightarrow x = (4-2y)/5y$ oe $g^{-1}(x) = (4-2x)/5x$ oe 0, 2 with no incorrect inequality $0 < x \leqslant 2$ oe, c.a.o.	M1 A1 B1,B1 B1	[5]	Must be a function of x
9	(i)	**XP** = −4**i** + (p – 5)**j** + 2**k** [−4**i** + (p – 5)**j** + 2**k**].(p**j** + 2**k**) = 0 $p^2 - 5p + 4 = 0$ $p = 1$ or 4	B1 M1 A1 A1	[4]	Or **PX** Attempt scalar prod with **OP/PO** and set = 0 (= 0 could be implied)
	(ii)	**XP** = −4**i** + 4**j** + 2**k** → |**XP**| = $\sqrt{16+16+4}$ Unit vector = 1 / 6 (−4**i** + 4**j** + 2**k**) oe	M1 A1	[2]	Expect 6
	(iii)	**AG** = −4**i** + 15**j** + 2**k** **XQ** = λ**AG** soi λ = 2/3 → **XQ** = $-\dfrac{8}{3}$**i** + 10**j** + $\dfrac{4}{3}$**k**	B1 M1 A1	[3]	

10 **(i)**	$3z-\frac{2}{z}=-1 \Rightarrow 3z^2+z-2=0$ $x^{1/2}(\text{or } z)=2/3 \text{ or } -1$ $x=4/9$ only	**M1** **A1** **A1**	[3]	Express as 3-term quad. Accept $x^{1/2}$ for z (OR $3x-1=-\sqrt{x},\ 9x^2-13x+4=0$ **M1, A1,A1** $x=4/9$)
(ii)	$f(x)=\frac{3x^{3/2}}{3/2}-\frac{2x^{1/2}}{1/2} \quad (+c)$ Sub $x=4, y=10 \quad 10=16-8+c \Rightarrow c=2$ When $x=\frac{4}{9},\ y=2\left(\frac{4}{9}\right)^{3/2}-4\left(\frac{4}{9}\right)^{1/2}+2$ $-2/27$	**B1B1** **M1A1** **M1** **A1**	[6]	 c must be present Substituting x value from part **(i)**
11 **(i)**	$\frac{dy}{dx}=-(x-1)^{-2}+9(x-5)^{-2}$ $m_{\text{tangent}}=-\frac{1}{4}+\frac{9}{4} = 2$ Equation of normal is $y-5=-½(x-3)$ $x=13$	**M1A1** **B1** **M1** **A1**	[5]	May be seen in part **(ii)** Through (3, 5) and with $m=-1/m_{tangent}$
(ii)	$(x-5)^2=9(x-1)^2$ $x-5=(\pm)3(x-1)$ or $(8)(x^2-x-2)=0$ $x=-1$ or 2 $\frac{d^2y}{dx^2}=2(x-1)^{-3}-18(x-5)^{-3}$ When $x=-1,\ \frac{d^2y}{dx^2}=-\frac{1}{6} < 0$ MAX When $x=2,\ \frac{d^2y}{dx^2}=\frac{8}{3} > 0$ MIN	**B1** **M1** **A1** **B1** **B1** **B1**	[6]	Set $\frac{dy}{dx}=0$ and simplify Simplify further and attempt solution If change of sign used, x values close to the roots must be used and all must be correct