Question	Answer	Marks	Partial Marks
9	$A(2, 0)$ or $x = 2$ [$x = 6$]	**2**	**M1** for factorising or solving $32x - 4x^2 - 48 = 0$
	Finds equation CD/ x-coordinate of C or D or maximum point : $x = 4$	**2**	**M1** for $\frac{2+6}{2}$ or $32 - 8x = 0$
	$D(4, 8)$ or [equation AB is $y =$] $4x - 8$	**2**	**M1** for $y = \frac{2}{3}\times 12$ or $m_{AB} = \frac{12-0}{5-2}$ soi
	$\left[\frac{32}{2}x^2 - \frac{4}{3}x^3 - 48x\right]_2^4$ or $\left[\frac{28}{2}x^2 - \frac{4}{3}x^3 - 40x\right]_2^4$	**B1**	**must be seen**
	Correct plan **including** correct substitution of upper and lower limits at some point e.g. $\left[16x^2 - \frac{4}{3}x^3 - 48x\right]_2^{their4} - \frac{1}{2}\times(their4 - 2)\times their8$ or $\left[16x^2 - \frac{4}{3}x^3 - 48x\right]_2^{their4} - [2x^2 - 8x]_2^{their4}$ or $\left[14x^2 - \frac{4}{3}x^3 - 40x\right]_2^{their4}$	**M1**	**dep** on attempt to integrate **FT** *their* 4 and *their* 8 if needed or **FT** *their* 4 and *their* $4x - 8$ of the form $mx + c$ if needed or **FT** *their* 4 and $(32 - their4)x - 4x^2 + (-48 - their(-8))$ providing clear evidence of the derivation of this has been seen
	$\frac{40}{3}$ isw or 13.3[33….] **nfww**	**A1**	**dep on all previous marks awarded**
10(a)	Valid explanation using f: f is one-one oe	**B1**	
10(b)	Complete method to find inverse function: Swaps the variables and rearranges or rearranges and swaps the variables	**M1**	Condone one sign or arithmetic error but must have the correct order of operations
	$\left[f^{-1}(x) =\right] -\sqrt{\ln x - 3}$ isw or $\left[f^{-1}(x) =\right] -\sqrt{\ln\frac{x}{e^3}}$ oe isw	**A2**	**A1** for $\left[f^{-1}(x) =\right]$ $[\pm]\sqrt{\ln x - 3}$ or $\left[f^{-1}(x) =\right]$ $[\pm]\sqrt{\ln\frac{x}{e^3}}$ oe
	Domain f^{-1}: $x > e^3$	**B1**	
	Range f^{-1}: $f^{-1} < 0$	**B1**	

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Question	Answer	Marks	Partial Marks
10(c)	$g(x) = f^{-1}(e^{2x})$ soi or $g(x) = -\sqrt{\ln e^{2x} - 3}$	**M1**	**FT** *their* expression for f^{-1}
	$-\sqrt{2x-3}$	**A1**	If 0 scored, allow **SCB1** for $-\sqrt{2x-3}$ found from solving $(g(x))^2 + 3 = 2x$ and using existence of composite functions to deduce that the square root must be negative
11	$2^n + n \times 2^{n-1} \times \frac{x}{2} + \frac{n(n-1)}{2[!]} \times 2^{n-2} \times \left(\frac{x}{2}\right)^2$ soi	**B1**	implied by three correct equations or e.g. $2^n + {}^nC_1 \times 2^{n-1} \times \frac{x}{2} + {}^nC_2 \times 2^{n-2} \times \left(\frac{x}{2}\right)^2$ **and** sight of ${}^nC_1 = n$ **and** ${}^nC_2 = \frac{n(n-1)}{2[!]}$ clearly in the working
	Forms three correct equations e.g. $b = 2^n$ $ab = n(2^{n-2})$ or $ab = n\frac{(2^{n-1})}{2}$ $\frac{9}{8}ab = n(n-1)(2^{n-5})$ or $\frac{9}{8}ab = \frac{n(n-1)}{2}\frac{(2^{n-2})}{2^2}$ OR finds e.g. $a = \frac{n}{4}$ and $\frac{9}{8}a = \frac{n(n-1)}{32}$ OR finds e.g. $ab = n \times \frac{b}{2} \times \frac{1}{2}$ and $\frac{9}{8}ab = \frac{n(n-1)}{2} \times \frac{b}{4} \times \frac{1}{4}$	**B3**	**B2** for any two of three correct equations or **B1** for any one of three correct equations **OR B2 for** $a = \frac{n}{4}$ or $\frac{9}{8}a = \frac{n(n-1)}{32}$ oe or $ab = n \times \frac{b}{2} \times \frac{1}{2}$ or $\frac{9}{8}ab = \frac{n(n-1)}{2} \times \frac{b}{4} \times \frac{1}{4}$ oe
	Finds a correct equation in n soi e.g. $n^2 - 10n = 0$ or $n - 1 = 9$ or $10n = n^2$ or $\frac{n}{4} = \frac{n(n-1)}{36}$ OR Finds a correct equation in a soi e.g. $16a^2 - 40a = 0$	**B1**	
	$n = 10$ $a = \frac{5}{2}$ oe $b = 1024$	**B3**	**B1** for each

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