Question	Scheme	Marks	AOs
8 (a)	$(2+ax)^8$ Attempts the term in $x^5 = {}^8C_5 2^3 (ax)^5 = 448a^5x^5$	M1 A1	1.1a 1.1b
	Sets $448a^5 = 3402 \Rightarrow a^5 = \dfrac{243}{32}$	M1	1.1b
	$\Rightarrow a = \dfrac{3}{2}$	A1	1.1b
		(4)	
(b)	Attempts either term. So allow for 2^8 or ${}^8C_4 2^4 a^4$	M1	1.1b
	Attempts the sum of both terms $2^8 + {}^8C_4 2^4 a^4$	dM1	2.1
	= 256 + 5670 = 5926	A1	1.1b
		(3)	
			(7 marks)

Notes

(a)

M1: An attempt at selecting the correct term of the binomial expansion. If all terms are given then the correct term must be used. Allow with a missing bracket ${}^8C_5 2^3 ax^5$ and left without the binomial coefficient expanded

A1: $448a^5x^5$ Allow unsimplified but ${}^8C_5$ must be "numerical"

M1: Sets their $448a^5 = 3402$ and proceeds to $\Rightarrow a^k = ...$ where $k \in \mathbb{N}$ $k \neq 1$

A1: Correct work leading to $a = \dfrac{3}{2}$

(b)

M1: Finds either term required. So allow for 2^8 or ${}^8C_4 2^4 a^4$ (even allowing with *a*)

dM1: Attempts the sum of both terms $2^8 + {}^8C_4 2^4 a^4$

A1: cso 5926

Question	Scheme	Marks	AOs
11(a)	$\left(2-\frac{x}{16}\right)^9 = 2^9 + \binom{9}{1}2^8.\left(-\frac{x}{16}\right)+\binom{9}{2}2^7.\left(-\frac{x}{16}\right)^2 + ...$	M1	1.1b
	$\left(2-\frac{x}{16}\right)^9 = 512 + ...$	B1	1.1b
	$\left(2-\frac{x}{16}\right)^9 = ... -144x + ...$	A1	1.1b
	$\left(2-\frac{x}{16}\right)^9 = ... + ... + 18x^2 \ (+ ...)$	A1	1.1b
		(4)	
(b)	Sets $'512'a = 128 \Rightarrow a = ...$	M1	1.1b
	$(a =)\frac{1}{4}$ oe	A1 ft	1.1b
		(2)	
(c)	Sets $'512'b + '-144'a = 36 \Rightarrow b = ...$	M1	2.2a
	$(b =)\frac{9}{64}$ oe	A1	1.1b
		(2)	
			(8 marks)

11(a) alt	$\left(2-\frac{x}{16}\right)^9 = 2^9\left(1-\frac{x}{32}\right)^9 = 2^9\left(1+\binom{9}{1}\left(-\frac{x}{32}\right)+\binom{9}{2}\left(-\frac{x}{32}\right)^2 + ...\right)$	M1	1.1b
	$= 512 + ...$	B1	1.1b
	$= ... -144x + ...$	A1	1.1b
	$= ... + ... + 18x^2 \ (+ ...)$	A1	1.1b

Notes

(a)

M1: Attempts the binomial expansion. May be awarded on either term two and/or term three
Scored for a correct binomial coefficient combined with a correct power of 2 and a correct power of $\left(\pm\frac{x}{16}\right)$ Condone $\binom{9}{2}2^7.\left(-\frac{x^2}{16}\right)$ for term three.

Allow any form of the binomial coefficient. Eg $\binom{9}{2} = {}^9C_2 = \frac{9!}{7!2!} = 36$

In the alternative it is for attempting to take out a factor of 2 (may allow 2^n outside bracket) and having a correct binomial coefficient combined with a correct power of $\left(\pm\frac{x}{32}\right)$

Question	Scheme	Marks	AOs
8(a)	2^6 or 64 as the constant term	B1	1.1b
	$\left(2+\frac{3x}{4}\right)^6 = ... + {}^6C_1 2^5\left(\frac{3x}{4}\right)^1 + {}^6C_2 2^4\left(\frac{3x}{4}\right)^2 + ...$ $= ... + 6\times2^5\left(\frac{3x}{4}\right)^1 + \frac{6\times5}{2}\times2^4\left(\frac{3x}{4}\right)^2 + ...$	M1 A1	1.1b 1.1b
	$= 64+144x+135x^2+...$	A1	1.1b
		(4)	
(b)	$\frac{3x}{4} = -0.075 \Rightarrow x = -0.1$ So find the value of $64+144x+135x^2$ with $x=-0.1$	B1ft	2.4
		(1)	
		(5 marks)	

Notes

(a)

B1: Sight of either 2^6 or 64 as the constant term

M1: An attempt at the binomial expansion. This may be awarded for a correct attempt at either the second **OR** third term. Score for the correct binomial coefficient with the correct power of 2 and the correct power of $\frac{3x}{4}$ condoning slips. Correct bracketing is not essential for this M mark.

Condone ${}^6C_2 2^4 \frac{3x^2}{4}$ for this mark

A1: Correct (unsimplified) second **AND** third terms.

The binomial coefficients must be processed to numbers /numerical expression e.g $\frac{6!}{4!2!}$ or $\frac{6\times5}{2}$

They cannot be left in the form ${}^6C_1$ and/or $\binom{6}{2}$

A1: $64+144x+135x^2+...$ Ignore any terms after this. Allow to be written $64, 144x, 135x^2$

(b)

B1ft: $x=-0.1$ or $-\frac{1}{10}$ **with** a comment about substituting this into their $64+144x+135x^2$

If they have written (a) as $64, 144x, 135x^2$ candidate would need to say substitute $x=-0.1$ into the sum of the first three terms.

As they do not have to perform the calculation allow

Set $2+\frac{3x}{4}=1.925$, solve for x and then substitute this value into the expression from (a)

If a value of x is found then it must be correct

Alternative to part (a)

$$\left(2+\frac{3x}{4}\right)^6 = 2^6\left(1+\frac{3x}{8}\right)^6 = 2^6\left(1+{}^6C_1\left(\frac{3x}{8}\right)^1 + {}^6C_2\left(\frac{3x}{8}\right)^2 + ...\right)$$

B1: Sight of either 2^6 or 64

Question	Scheme	Marks	AOs
6 (a)	$(1+kx)^{10} = 1 + \binom{10}{1}(kx)^1 + \binom{10}{2}(kx)^2 + \binom{10}{3}(kx)^3 ...$	M1 A1	1.1b 1.1b
	$= 1 + 10kx + 45k^2x^2 + 120k^3x^3 ...$	A1	1.1b
		(3)	
(b)	Sets $120k^3 = 3 \times 10k$	B1	1.2
	$4k^2 = 1 \Rightarrow k = ...$	M1	1.1b
	$k = \pm\frac{1}{2}$	A1	1.1b
		(3)	
			(6 marks)

(a)

M1: An attempt at the binomial expansion. This may be awarded for either the second or third term or fourth term. The coefficients may be of the form ${}^{10}C_1$, $\binom{10}{2}$ etc or eg $\frac{10\times9\times8}{3!}$

A1: A correct unsimplified binomial expansion. The coefficients must be numerical so cannot be of the form ${}^{10}C_1$, $\binom{10}{2}$. Coefficients of the form $\frac{10\times9\times8}{3!}$ are acceptable for this mark.

The bracketing must be correct on $(kx)^2$ but allow recovery

A1: $1 + 10kx + 45k^2x^2 + 120k^3x^3 ...$ or $1 + 10(kx) + 45(kx)^2 + 120(kx)^3 ...$
Allow if written as a list.

(b)

B1: Sets their $120k^3 = 3 \times$ their $10k$ (Seen or implied)
For candidates who haven't cubed allow $120k = 3 \times$ their $10k$

If they write $120k^3x^3 = 3 \times$ their $10kx$ only allow recovery of this mark if x disappears afterwards.

M1: Solves a cubic of the form $Ak^3 = Bk$ by factorising out/cancelling the k and proceeding correctly to at least one value for k. Usually $k = \sqrt{\frac{B}{A}}$

A1: $k = \pm\frac{1}{2}$ o.e ignoring any reference to 0

Question	Scheme	Marks	AOs
7(a)	$\left(2-\frac{x}{2}\right)^7 = 2^7 + \binom{7}{1}2^6.\left(-\frac{x}{2}\right)+\binom{7}{2}2^5.\left(-\frac{x}{2}\right)^2 + ...$	M1	1.1b
	$\left(2-\frac{x}{2}\right)^7 = 128 + ...$	B1	1.1b
	$\left(2-\frac{x}{2}\right)^7 = ... -224x + ...$	A1	1.1b
	$\left(2-\frac{x}{2}\right)^7 = ... + ... + 168x^2 \; (+ ...)$	A1	1.1b
		(4)	
(b)	Solve $\left(2-\frac{x}{2}\right) = 1.995$ so $x = 0.01$ and state that 0.01 would be substituted for x into the expansion	B1	2.4
		(1)	
		(5 marks)	

Notes:

(a)

M1: Need correct binomial coefficient with correct power of 2 and correct power of x. Coefficients may be given in any correct form; e.g. 1, 7, 21 or ${}^7C_0$, ${}^7C_1$, ${}^7C_2$ or equivalent

B1: Correct answer, simplified as given in the scheme

A1: Correct answer, simplified as given in the scheme

A1: Correct answer, simplified as given in the scheme

(b)

B1: Needs a full explanation i.e. to state $x = 0.01$ and that this would be substituted and that it is a solution of $\left(2-\frac{x}{2}\right) = 1.995$

Question Number	Scheme	Marks
1.	$\left(3-\frac{1}{3}x\right)^5$ - $3^5 + {}^5C_1 3^4(-\frac{1}{3}x) + {}^5C_2 3^3(-\frac{1}{3}x)^2 + {}^5C_3 3^2(-\frac{1}{3}x)^3 ...$ First term of 243 $\left({}^5C_1 \times ... \times x\right) + \left({}^5C_2 \times ... \times x^2\right) + \left({}^5C_3 \times ... \times x^3\right) ...$ $=(243 ..) -\frac{405}{3}x + \frac{270}{9}x^2 - \frac{90}{27}x^3 ...$ $=(243 ..) -135x + 30x^2 - \frac{10}{3}x^3 ..$	 B1 M1 A1 A1 (4) **[4]**
Alternative method	$\left(3-\frac{1}{3}x\right)^5 = 3^5(1-\frac{x}{9})^5$ $3^5(1 + {}^5C_1(-\frac{1}{9}x) + {}^5C_2(-\frac{1}{9}x)^2 + {}^5C_3(-\frac{1}{9}x)^3 \; ...)$ Scheme is applied exactly as before	

Notes

B1: The constant term should be 243 in their expansion

M1: Two of the three binomial coefficients must be correct and must be with the correct power of x. Accept ${}^5C_1$ or $\binom{5}{1}$ or 5 **as a coefficient, and** ${}^5C_2$ or $\binom{5}{2}$ or 10 **as another and** ${}^5C_3$ or $\binom{5}{3}$ or 10 **as another……..** Pascal's triangle may be used to establish coefficients. NB: If they only include the first two of these terms then the M1 may be awarded.

A1: Two of the final three terms correct – may be unsimplified i.e. two of $-135x + 30x^2 - \frac{10}{3}x^3$ correct, or two of $-\frac{405}{3}x + \frac{270}{9}x^2 - \frac{90}{27}x^3$ (may be just two terms)

A1: All three final terms correct and simplified. (Can be listed with commas or appear on separate lines. Accept in reverse order.) Accept correct alternatives to $-\frac{10}{3}$ e.g. $-3\frac{1}{3}$ or $-3.\dot{3}$ the recurring must be clear. 3.3 is not acceptable. Allow e.g. $+-135x$

e.g. The common error $3^5 + {}^5C_1 3^4(-\frac{1}{3})x + {}^5C_2 3^3(-\frac{1}{3})x^2 + {}^5C_3 3^2(-\frac{1}{3})x^3 = (243) -135x - 90x^2 - 30x^3$ would earn B1, M1, A0, A0, so 2/4

If extra terms are given then isw

No negative signs in answer also earns B1, M1, A0, A0

If the series is divided through by 3 at the final stage after an error or omission resulting in all multiple of three coefficients then apply scheme to series before this division and ignore subsequent work (isw)

Special Case: Only gives first three terms $=(243 ..) -135x + 30x^2$ ... or $243 - \frac{405}{3}x + \frac{270}{9}x^2$

Follow the scheme to give B1 M1 A1 A0 special case. (Do not treat as misread.)

Answers such as $243 \; + 405 - \frac{1}{3}x + 270 - \frac{1}{9}x^2 + 90 - \frac{1}{27}x^3 ..$ gain no credit as the binomial coefficients are not linked to the x terms.

Question Number	Scheme		Marks
5.	(a) $\left(2-9x\right)^4 = 2^4 + {}^4C_1 2^3(-9x) + {}^4C_2 2^2(-9x)^2$, (b) $\mathrm{f}(x) = \left(1+kx\right)\left(2-9x\right)^4 = A - 232x + Bx^2$		
(a)	First term of 16 in their final series		B1
Way 1	At least one of $\left({}^4C_1 \times \ldots \times x\right)$ or $\left({}^4C_2 \times \ldots \times x^2\right)$		M1
	$= (16) - 288x + 1944x^2$	At least one of $-288x$ or $+1944x^2$	A1
		Both $-288x$ **and** $+1944x^2$	A1
			[4]
(a)	$(2-9x)^4 = (4-36x+81x^2)(4-36x+81x^2)$		
		First term of 16 in their final series	B1
Way 2	$= 16 - 144x + 324x^2 - 144x + 1296x^2 + 324x^2$	Attempts to multiply a 3 term quadratic by the same 3 term quadratic to achieve either 2 terms in x or at least 2 terms in x^2.	M1
	$= (16) - 288x + 1944x^2$	At least one of $-288x$ or $+1944x^2$	A1
		Both $-288x$ **and** $+1944x^2$	A1
			[4]
(a) **Way 3**	$\left\{(2-9x)^4 =\right\}\ 2^4\left(1-\frac{9}{2}x\right)^4$	First term of 16 in final series	B1
	$= 2^4\left(1 + \underline{4\left(-\frac{9}{2}x\right) + \frac{4(3)}{2}\left(-\frac{9}{2}x\right)^2} + \ldots\right)$	At least one of $\underline{\left(4\times\ldots\times x\right) \text{ or } \left(\frac{4(3)}{2}\times\ldots\times x^2\right)}$	M1
	$= (16) - 288x + 1944x^2$	At least one of $-288x$ or $+1944x^2$	A1
		Both $-288x$ **and** $+1944x^2$	A1
			[4]
	Parts (b), (c) and (d) may be marked together		
(b)	$A = "16"$	Follow through their value from (a)	B1ft
			[1]
(c)	$\left\{\left(1+kx\right)\left(2-9x\right)^4\right\} = (1+kx)\left(16 - 288x + \left\{1944x^2 + \ldots\right\}\right)$	*May be seen in part (b) or (d) and can be implied by work in parts (c) or (d).*	M1
	x terms: $-288x + 16kx = -232x$		
	giving, $16k = 56 \Rightarrow \underline{k = \frac{7}{2}}$	$\underline{k = \frac{7}{2}}$	A1
			[2]
(d)	x^2 terms: $1944x^2 - 288kx^2$		
	So, $B = 1944 - 288\left(\frac{7}{2}\right);\ = 1944 - 1008 = 936$	See notes	M1
		936	A1
			[2]
			9

Question Number	Scheme	Marks
11.(a)	$(3+ax)^5 = 3^5 + \binom{5}{1}3^4.(ax)+\binom{5}{2}3^3.(ax)^2+...$	M1
	$= 243, +405ax + 270a^2x^2 + ...$	B1, A1, A1
		[4]
(b)	$f(x) = (a-x)(3+ax)^5 = (a-x)(243+405ax+270a^2x^2+...)$	
	$-243+405a^2 = 0 \Rightarrow a^2 = \frac{243}{405} \Rightarrow a = \sqrt{\frac{3}{5}}$ or equivalent	M1,dM1A1
		[3]
		(7 marks)

(a)

M1 This method mark is awarded for an attempt at a Binomial expansion to get the second and/or third term – it requires a correct binomial coefficient combined with correct power of 3 and the correct power of x. Ignore bracketing errors. Accept any notation for ${}^5C_1$, ${}^5C_2$, e.g. as on scheme or 5, and 10 from Pascal's triangle. This mark may be given if no working is shown, if either or both of the terms including x is correct.

An alternative is $(3+ax)^5 = 3^5\left\{1+\frac{ax}{3}\right\}^5 = 3^5\{1+5\times\frac{ax}{3}+\frac{5\times 4}{2(!)}\times\left(\frac{ax}{3}\right)^2$

In this method it is scored for the correct attempt at a binomial expansion to get the second and/or third term in the bracket of $3^n\{1+5\times\frac{ax}{3}+\frac{5\times 4}{2(!)}\times\left(\frac{ax}{3}\right)^2 ......\}$

Score for binomial coefficient with the correct power of $\left(\frac{x}{3}\right)$ Eg. $5\times\frac{..x}{3}$ or $10\times\left(\frac{..x}{3}\right)^2$

B1 Must be simplified to 243 (writing just 3^5 is B0).

A1 cao and is for one correct from $405ax$, and $270a^2x^2$ Also allow $270(ax)^2$ with the bracket

A1 cao and is for both of $405a\,x$, and $270a^2x^2$.

Allow $270(ax)^2$ with the bracket correct (ignore extra terms). Allow listing for all marks

It is possible to score 1011 in (a)

There are a minority of students who attempt this in (a)

$f(x) = (a-x)(3+ax)^5 = (a-x)(243+405ax+270a^2x^2+...)$ and go on to expand this.

They can have all the marks in part (a)

(b)

M1 Attempt to set the coefficient of x in the expansion of $(a-x)(3+ax)^5$ equal to 0

$(a-x)(3+ax)^5 = (a-x)\left(P+Qax+Ra^2x^2+...\right) = aP+\left(a^2Q-P\right)x+...$

For this to be scored you must see an equation of the form $\pm P \pm Qa^2 = 0$ You are condoning slips/ sign errors

dM1 For $\pm P \pm Qa^2 = 0 \Rightarrow a = ...$ using a correct method. This cannot be scored for an attempt at sq rooting a negative number

A1 $a = \sqrt{\frac{3}{5}}$ or exact equivalent such as $a = \frac{\sqrt{15}}{5}$ You may ignore any reference to $a = -\sqrt{\frac{3}{5}}$

Question Number	Scheme	Marks
10 (a)	2^{10} OR 1024 seen as the constant term	B1
	$\left(2-\frac{x}{8}\right)^{10} = 2^{10} + {}^{10}C_1 2^9\left(-\frac{x}{8}\right)^1 + {}^{10}C_2 2^8\left(-\frac{x}{8}\right)^2 +$	M1A1
	$=1024-640x+180x^2$	A1
		(4)
	$\left(2-\frac{x}{8}\right)^{10}(a+bx)=\left(1024-640x+180x^2\right)(a+bx)$	
(b)	$1024a=256 \Rightarrow a=\frac{1}{4}$ oe	M1A1
		(2)
(c)	$1024b-640a=352 \Rightarrow b=\frac{1}{2}$	M1A1
		(2)
		(8 marks)

(a)

B1 2^{10} OR 1024 seen as the constant term

M1 For a correct attempt at the binomial expansion for $(a+b)^n$ with a =2, $b=\pm\frac{x}{8}$ and n=10

Condone missing brackets. Accept any unsimplified term in x as evidence

Accept a power series expansion on $(1\pm kx)^{10}=1+10(\pm kx)+\frac{10\times 9}{2}(\pm kx)^2$ condoning missing brackets. Again accept any unsimplified term in x as evidence

A1 A completely correct unsimplified solution.

Accept $=2^{10}+{}^{10}C_1 2^9\left(-\frac{x}{8}\right)^1+{}^{10}C_2 2^8\left(-\frac{x}{8}\right)^2+$

Accept $=2^{10}\left(1+10\times\left(-\frac{x}{16}\right)+\frac{10\times 9\times\left(-\frac{x}{16}\right)^2}{2!}+..\right)$

A1 $1024-640x+180x^2$ Accept $1024+-640x+180x^2$

Can be listed with commas or appear on separate lines. Accept in reverse order.

(b)

M1 Sets their $'1024'\times a=256$

A1 $a=\frac{1}{4}$. Accept equivalents such as 0.25.

Accept this for both marks (it can be done by substituting $x=0$ into both sides of the expression) as long as it is not found from an incorrect method

(c)

M1 Sets their $'1024'\times b\pm$ their $'640'a=352$

A1 $b=\frac{1}{2}$ or 0.5

Question Number	Scheme		Marks
	Mark (a) and (b) together		
10(a)	$(1+ax)^{20} = 1^{20} + {}^{20}C_1 1^{19}(ax)^1 + {}^{20}C_2 1^{18}(ax)^2$. Note that the notation $\binom{20}{1}$ may be seen for ${}^{20}C_1$ etc.		
	${}^{20}C_1 1^{19}(ax)^1 = 4x \Rightarrow 20a = 4 \Rightarrow a = 0.2$	M1: Uses either ${}^{20}C_1(1^{19})(ax)^1 = 4x^1$ or $20a = 4$ to obtain a value for a. A1: $a = 0.2$ or equivalent	M1A1
			(2)
(b)	${}^{20}C_2 1^{18}(ax)^2 = px^2$ $\Rightarrow \frac{20\times19}{2}\times('0.2')^2 = p$ $\Rightarrow p = ...$	Uses ${}^{20}C_2(1^{18})(ax)^2 = px^2$ and their value of a to find a value for p. Condone the use of a rather than a^2 in finding p. Maybe implied by an attempt to find a value for $190a^2$ or $190a$. Note: ${}^{20}C_{18}$ can be used for ${}^{20}C_2$	M1
	$p = 7.6$	Accept equivalents such as $\frac{38}{5}, \frac{190}{25}$	A1
			(2)
(c)	Term is ${}^{20}C_4 1^{16}(ax)^4 \Rightarrow q = ...$	Identifies the correct term and uses their value of a to find a value for q. Condone the use of a rather than a^4. Must be an attempt to calculate ${}^{20}C_4 a^4$ or ${}^{20}C_4 a$ or ${}^{20}C_{16} a^4$ or ${}^{20}C_{16} a$	M1
	$q = {}^{20}C_4 \times 0.2^4 = \frac{969}{125} = (7.752)$	$q = \frac{969}{125}$ or exact equivalent e.g. 7.752, $7\frac{94}{125}$. $q = \frac{969}{125}x^4$ scores A0 but $qx^4 = \frac{969}{125}x^4$ scores A1.	A1
			(2)
			(6 marks)

Question	Scheme	Marks
5.	(a) $\left(3-\frac{ax}{2}\right)^5 = 3^5 + \binom{5}{1}3^4.\left(-\frac{ax}{2}\right)+\binom{5}{2}3^3.\left(-\frac{ax}{2}\right)^2+\binom{5}{3}3^2.\left(-\frac{ax}{2}\right)^3...$	M1
	$= 243, -\frac{405}{2}ax + \frac{135}{2}a^2x^2 - \frac{45}{4}a^3x^3...$	B1, A1, A1
		[4]
	(b) $\frac{405}{2}a = \frac{45}{4}a^3$	M1
	$a^2 = \frac{810}{45} = 18$ or equivalent	A1
	$a = 3\sqrt{2}$	A1
		[3]
		7 marks
	Notes	

(a)

M1: The **method** mark is awarded for an attempt at Binomial to get the second and/or third and/or fourth term.

You need to see the **correct** binomial coefficient combined with correct power of *x*. e.g. $\binom{5}{2}..x^2$

Condone bracket errors. Accept any notation for ${}^5C_1$, ${}^5C_2$ and ${}^5C_3$, e.g. $\binom{5}{1}$, $\binom{5}{2}$ and $\binom{5}{3}$

or 5, 10 and 10 from Pascal's triangle.

The mark can be applied in the same way if 3^5 is taken out as a factor.

B1: For the first term of 243. (writing just 3^5 is **B0).**

A1: is cao and is for **two correct and simplified terms** from $-\frac{405}{2}ax$, $+\frac{135}{2}a^2x^2$ and $-\frac{45}{4}a^3x^3...$

Allow two correct from $-\frac{405}{2}(ax)$, $+\frac{135}{2}(ax)^2$ and $-\frac{45}{4}(ax)^3...$ with the brackets.

Allow decimals. Allow lists

A1: is c.a.o and is for **all** of the terms correct and simplified.

Allow $+\frac{135}{2}(ax)^2$ and $-\frac{45}{4}(ax)^3...$ (ignore x^4 terms)

Allow decimal equivalents $-202.5\,ax + 67.5\,a^2x^2 - 11.25\,a^3x^3...$ Allow listing.

(b)

M1: Puts their coefficient of *x* equal to their coefficient of x^3 (There should be no *x* terms)

A1: This is cao for obtaining a^2 or *a* correctly (may be unsimplified)

A1: This is cao for $a = 3\sqrt{2}$ Condone $a = \pm 3\sqrt{2}$

We will condone all 3 marks to be scored in (b) from a solution in (a) where all signs are +ve

$$= 243 + \frac{405}{2}ax + \frac{135}{2}a^2x^2 + \frac{45}{4}a^3x^3...$$

Question Number	Scheme	Marks
1	$(1+px)^8 = 1+8(px)+\frac{8\times 7}{2!}(px)^2$	M1
	Compares coefficients in $x \Rightarrow 8p=12 \Rightarrow p=1.5$	M1A1
	Compares coefficients in $x^2 \Rightarrow q=28p^2 \Rightarrow q=63$	M1A1
		(5) **(5 marks)**

(a)

M1 Uses the power series expansion/ binomial expansion with the correct form for terms 2 and 3. You may ignore the first term in this question.
Accept the correct coefficient with the correct power of x for terms 2 and 3.
$(1+px)^8 = 1+8(..x)+\frac{8\times 7}{2!}(..x)^2$
Allow missing bracket on x^2 term.
Allow for $(1+px)^8 = 1+\binom{8}{1}(..x)+\binom{8}{2}(..x)^2$ or equivalent.
Allow sight of $\binom{8}{1}(..x)$ and $\binom{8}{2}(..x)^2$ separated by commas

M1 Sets their coefficient in x equal to 12 $\Rightarrow 8p=12 \Rightarrow p=...$
It is not dependent on the previous M but it must be of the form $kp=12 \Rightarrow p=...$

A1 $p=1.5$ or equivalent such as $\frac{12}{8}$

M1 Sets q equal to their coefficient of x^2 (which must include a p or a p^2) then substitutes in their value of p leading to $q=$

A1 $q=63$

Question Number	Scheme	Marks
7(a)	$(1+kx)^8 = 1+\binom{8}{1}(kx)+\binom{8}{2}(kx)^2+\binom{8}{3}(kx)^3...$!!	M1
	$= 1+8kx, +28k^2x^2, +56k^3x^3+...$!	B1, A1, A1
	!	[4]
(b)	Sets $"56k^3" = 1512$ and obtains! $k^3 = \frac{1512}{56}$	M1 A1
	So $k = 3$	A1
		[3]
		7 marks
	Notes	
(a)	**M1**: The **method** mark is awarded for an attempt at the Binomial expansion to get the third **and/or** fourth term. The **correct** binomial coefficient needs to be combined with the correct power of *x*. Ignore bracket errors and omission of or incorrect powers of *k*. Accept any notation for ${}^8C_2$ or ${}^8C_3$, e.g. $\binom{8}{2}$ or $\binom{8}{3}$ or 28 or 56 from Pascal's triangle. This mark may be given if no working is shown, but either or both of $28k^2x^2$ and $56k^3x^3$ is found. **B1:** This is for 1 + 8*kx* and not for just $1+\binom{8}{1}(kx)$ **A1:** is cao and is for $28k^2x^2$ or for $28(kx)^2$ **A1:** is cao and is for $56k^3x^3$ or for $56(kx)^3$ Any extra terms in higher powers of *x* should be ignored. Allow terms separated by commas or given as a list for all the marks.	
(b)	**M1:** Sets their coefficient of $x^3 = 1512$ and obtains $k^n = ..$ where *n* is 1 or 3 **A1:** $k^3 = \frac{1512}{56}$ or equivalent e.g. 27 (May be implied by their final answer) **A1:** $k = 3$ cao (± 3 is A0) **Note (b) can be marked independently of part (a) so part (a) might be incorrect or not attempted but they have $56k^3 = 1512$ etc. in (b)**	

! !

Question Number	Scheme	Marks
6.(a)	$(2+ax)^6 = 2^6 + \binom{6}{1}2^5.(ax) + \binom{6}{2}2^4.(ax)^2 + ...$	M1
	$= 64, +192ax + 240a^2x^2 + ...$	B1, A1, A1
		[4]
(b)	$192a = 240a^2$	M1
	$a = \frac{192}{240} = 0.8$ or equivalent	A1
		[2] **6 marks**
Alt 6.(a)	$(2+ax)^6 = 2^6\left(1+\frac{a}{2}x\right)^6 = 2^6\left(1+6\times\frac{a}{2}x+\frac{6\times5}{2}\left(\frac{a}{2}x\right)^2+...\right)$	**M1**
	$= 64, +192ax + 240a^2x^2 + ...$	**B1, A1, A1**
		[4]

(a)

M1 The method mark is awarded for an attempt at a Binomial expansion to get an unsimplified second or third term – Look for a correct binomial coefficient multiplied by a correct power of *x*. Eg ${}^6C_1...x$ or ${}^6C_2..x^2$
Condone bracket errors or errors (or omissions) in the powers of 2.
Accept any notation for ${}^6C_1$, ${}^6C_2$, e.g. as on scheme or 6, and 15 from Pascal's triangle.
This mark may be given if no working is shown, if either or both of the terms including *x* is correct.
If the candidate attempts the expansion in descending powers allow ${}^6C_5...x^5$ or ${}^6C_4..x^4$ oe.
In the alternative it is for the correct form inside the bracket accepting either $1+6\times\frac{a}{2}x+\frac{6\times5}{2}\left(\frac{a}{2}x\right)^2$ or $1+6\times\frac{a}{2}x+\frac{6\times5}{2}\frac{a}{2}x^2$

B1 Must be simplified to 64 (writing just 2^6 is B0).

A1 Score for either of $192a\,x$ or $240a^2x^2$ correct. Allow $240a^2x^2$ appearing as $240(ax)^2$ with the bracket

A1 Score for both of $192a\,x$ and $240a^2x^2$ correct. Allow $240a^2x^2$ appearing as $240(ax)^2$ with the bracket
Allow listing of terms $64,\ 192ax,\ 240a^2x^2$ for all 4 marks.

(b)

M1 Score for setting the coefficients of their *x* and x^2 terms equal. They must reach an equation not involving *x*'s.
A1 This is cso for any equivalent fraction or decimal to 0.8. Ignore any reference to $a = 0$.