Binomial Expansion - Edexcel Past Exam Questions MARK SCHEME

Question 1: Jan 05 Q1

Question Number	Scheme	Marks
	$(3+2x)^5 = (3^5) + \binom{5}{1}3^4 \cdot (2x) + \binom{5}{2}3^3(2x)^2 + \cdots$ $= \underline{\underline{243, +810x, +1080x^2}}$	M1 B1, A1, A1 (4)
	M1: Use of binomial leading to correct expression for x <u>or</u> x^2 term. $\binom{n}{r}$ is ok can be implied.	

Question 2: June 05 Q4

Question number	Scheme	Marks
	(a) $1 + 12px, + \frac{12\times 11}{2}(px)^2$	B1, B1 (2)
	(b) $12p(x) = -q(x)$ $\quad 66p^2(x^2) = 11q(x^2)$ (Equate terms, or coefficients)	M1
	$\Rightarrow \quad 66p^2 = -132p$ (Eqn. in p or q only)	M1
	$p = -2, \quad q = 24$	A1, A1 (4) **6**
	(a) Terms can be listed rather than added. First B1: Simplified form must be seen, but may be in (b). (b) First M: May still have $\binom{12}{2}$ or ${}^{12}C_2$ Second M: <u>Not</u> with $\binom{12}{2}$ or ${}^{12}C_2$. Dependent upon having p's in each term. Zero solutions must be rejected for the final A mark.	

Question 3: Jan 06 Q2

Question number	Scheme	Marks
	(a) $(1+px)^9 = 1+9px\ ;\ +\binom{9}{2}(px)^2$	B1 B1 (2)
	(b) $9p = 36$, so $\underline{p=4}$	M1 A1
	$q = \frac{9\times 8}{2}p^2$ or $36p^2$ or $36p$ if that follows from their (a)	M1
	So $\underline{q = 576}$	A1cao (4)
		6
	(a) 2^{nd} B1 for $\binom{9}{2}(px)^2$ or better. Condone " ," not " +". (b) 1^{st} M1 for a linear equation for p. 2^{nd} M1 for either printed expression, follow through their p.	
N.B.	$1+9px+36px^2$ leading to $p=4$, $q=144$ scores B1B0 M1A1M1A0 i.e 4/6	

Question 4: June 06 Q1

Question number	Scheme	Marks
	$(2+x)^6 = \ 64\ \ldots$	B1
	$+(6\times 2^5 \times x)+\left(\frac{6\times 5}{2}\times 2^4 \times x^2\right)$, $\quad +192x, \quad +240x^2$	M1, A1, A1 (4)
		4
	The terms can be 'listed' rather than added. M1: Requires correct structure: 'binomial coefficients' (perhaps from Pascal's triangle), increasing powers of one term, decreasing powers of the other term (this may be 1 if factor 2 has been taken out). Allow 'slips'. $\binom{6}{1}$ and $\binom{6}{2}$ or equivalent are acceptable, or even $\left(\frac{6}{1}\right)$ and $\left(\frac{6}{2}\right)$. <u>Decreasing powers of x:</u> Can score only the M mark. $64(1+\ldots\ldots..)$, even if all terms in the bracket are correct, scores max. B1M1A0A0.	

Question 5: Jan 07 Q2

Question Number	Scheme	Marks
(a)	$(1-2x)^5 = 1 + 5\times(-2x) + \frac{5\times4}{2!}(-2x)^2 + \frac{5\times4\times3}{3!}(-2x)^3 + \ldots$ $= 1 - 10x + 40x^2 - 80x^3 + \ldots$	B1, M1, A1, A1 (4)
(b)	$(1+x)(1-2x)^5 = (1+x)(1-10x+\ldots)$ $= 1 + x - 10x + \ldots$ $\approx 1 - 9x$ (✱)	M1 A1 (2) **(6)**

Notes

2(a)	
$1-10x$ $1-10x$ must be seen in this simplified form in (a).	B1
Correct structure: 'binomial coefficients' (perhaps from Pascal's triangle), increasing powers of x. Allow slips. Accept other forms: ${}^5C_1$, $\binom{5}{1}$, also condone $\left(\frac{5}{1}\right)$ but must be attempting to use 5. Condone use of invisible brackets and using $2x$ instead of $-2x$. Powers of x: at least 2 powers of the type $(2x)^a$ or $2x^a$ seen for $a \geq 1$.	M1
$40x^2$ (1st A1)	A1
$-80x^3$ (2nd A1)	A1
Allow commas between terms. Terms may be listed rather than added Allow 'recovery' from invisible brackets, so $1^5 + \binom{5}{1}1^4.-2x + \binom{5}{2}1^3.-2x^2 + \binom{5}{3}1^2.-2x^3$ $= 1 - 10x + 40x^2 - 80x^3 + \ldots$ gains full marks. $1 + 5\times(2x) + \frac{5\times4}{2!}(2x)^2 + \frac{5\times4\times3}{3!}(2x)^3 + \ldots = 1 + 10x + 40x^2 + 80x^3 + \ldots$ gains B0M1A1A0	
Misread: first 4 terms, descending terms: if correct, would score B0, M1, 1st A1: one of $40x^2$ and $-80x^3$ correct; 2nd A1: both $40x^2$ and $-80x^3$ correct.	

2(a) Long multiplication	
$(1-2x)^2 = 1 - 4x + 4x^2$, $(1-2x)^3 = 1 - 6x + 12x^2 - 8x^3$, $(1-2x)^4 = 1 - 8x + 24x^2 - 32x^3$ $\{+16x^4\}$ $(1-2x)^5 = 1 - 10x + 40x^2 + 80x^3 + \ldots$	
$1-10x$ $1-10x$ must be seen in this simplified form in (a).	B1
Attempt repeated multiplication up to and including $(1-2x)^5$	M1
$40x^2$ (1st A1)	A1
$-80x^3$ (2nd A1)	A1
Misread: first 4 terms, descending terms: if correct, would score B0, M1, 1st A1: one of $40x^2$ and $-80x^3$ correct; 2nd A1: both $40x^2$ and $-80x^3$ correct.	

Question 6: June 07 Q3

Question number	Scheme	Marks
	(a) $1+6kx$ [Allow unsimplified versions, e.g. $1^6+6(1^5)kx$, ${}^6C_0+{}^6C_1kx$]	B1
	$+\frac{6\times5}{2}(kx)^2+\frac{6\times5\times4}{3\times2}(kx)^3$ [See below for acceptable versions]	M1 A1 (3)
	N.B. THIS NEED NOT BE SIMPLIFIED FOR THE A1 (isw is applied)	
	(b) $6k=15k^2$ $k=\frac{2}{5}$ (or equiv. fraction, or 0.4) (Ignore $k=0$, if seen)	M1 A1cso (2)
	(c) $c=\frac{6\times5\times4}{3\times2}\left(\frac{2}{5}\right)^3=\frac{32}{25}$ (or equiv. fraction, or 1.28)	A1cso (1)
	(Ignore x^3, so $\frac{32}{25}x^3$ is fine)	
		6

	(a) The terms can be 'listed' rather than added. M1: Requires correct structure: 'binomial coefficients' (perhaps from Pascal's triangle), increasing powers of x. Allow a 'slip' or 'slips' such as: $+\frac{6\times5}{2}kx^2+\frac{6\times5\times4}{3\times2}kx^3$, $+\frac{6\times5}{2}(kx)^2+\frac{6\times5}{3\times2}(kx)^3$ $+\frac{5\times4}{2}kx^2+\frac{5\times4\times3}{3\times2}kx^3$, $+\frac{6\times5}{2}x^2+\frac{6\times5\times4}{3\times2}x^3$ But: $15+k^2x^2+20+k^3x^3$ or similar is M0. Both x^2 and x^3 terms must be seen. $\binom{6}{2}$ and $\binom{6}{3}$ or equivalent such as ${}^6C_2$ and ${}^6C_3$ are acceptable, and even $\left(\frac{6}{2}\right)$ and $\left(\frac{6}{3}\right)$ are acceptable for the method mark. A1: Any correct (possibly unsimplified) version of these 2 terms. $\binom{6}{2}$ and $\binom{6}{3}$ or equivalent such as ${}^6C_2$ and ${}^6C_3$ are acceptable. Descending powers of x: Can score the M mark if the required first 4 terms are not seen. Multiplying out $(1+kx)(1+kx)(1+kx)(1+kx)(1+kx)(1+kx)$: M1: A full attempt to multiply out (power 6) B1 and A1 as on the main scheme. (b) M: Equating the coefficients of x and x^2 (even if trivial, e.g. $6k=15k$). Allow this mark also for the 'misread': equating the coefficients of x^2 and x^3. An equation in k alone is required for this M mark, although… …condone $6kx=15k^2x^2 \Rightarrow (6k=15k^2 \Rightarrow)\ k=\frac{2}{5}$.	

Question 7: Jan 08 Q3

Question Number	Scheme	Marks
(a)	$\left(1+\frac{1}{2}x\right)^{10}$ **=** 1 + $\underline{\binom{10}{1}\left(\frac{1}{2}x\right)+\binom{10}{2}\left(\frac{1}{2}x\right)^2+\binom{10}{3}\left(\frac{1}{2}x\right)^3}$	M1 A1
	= 1 + $5x$; + $\frac{45}{4}$(or 11.25)x^2 + $15x^3$ (coeffs need to be these, i.e, simplified)	A1; A1 (4)
	[Allow A1A0, if totally correct with unsimplified, single fraction coefficients)	
(b)	$(1+\frac{1}{2}\times 0.01)^{10}$ = 1 + 5(0.01) + $(\frac{45}{4}\ or 11.25)(0.01)^2$ + $15(0.01)^3$	M1 A1√
	= 1 + 0.05 + 0.001125 + 0.000015	
	= 1.05114 cao	A1 (3) **[7]**
Notes:	(a) For M1 first A1: Consider underlined expression only. M1 Requires correct structure for at least two of the three terms: (i) Must be attempt at binomial coefficients. [Be generous :allow all notations e.g. ${}^{10}C_2$, even $\left(\frac{10}{2}\right)$; allow "slips".] (ii) Must have increasing powers of x , (iii) May be listed, need not be added; *this applies for all marks.* First A1: Requires **all three** correct terms but need not be simplified, allow 1^{10} etc, ${}^{10}C_2$ etc, and condone omission of brackets around powers of ½x Second A1: Consider as B1: **1 + 5x can score A1 on Epen, even after M0** (b) For M1: Substituting **their** (0.01) into their (a) result [0.1, 0.001, 0.25, 0.025,0.0025 acceptable but **not** 0.005 or 1.005] First A1 (f.t.): Substitution of (**0.01**) into **their 4 termed** expression in (a) **Answer with no working** scores **no marks** (calculator gives this answer)	

Question 8: June 08 Q3

Question Number	Scheme	Marks
(a)	$(1+ax)^{10}=1+10ax......$	B1
	$+\frac{10\times 9}{2}(ax)^2+\frac{10\times 9\times 8}{6}(ax)^3$	M1
	$+45(ax)^2,\ +120(ax)^3$ or $+45a^2x^2,\ +120a^3x^3$	A1 A1 (4)
(b)	$120a^3=2\times 45a^2$ $\quad a=\frac{3}{4}$ or equiv. $\left(\text{e.g. } \frac{90}{120}, 0.75\right)$	M1 A1 (2)
		(6 marks)

Question 9: Jan 09 Q1

Question Number	Scheme	Marks
	$(3-2x)^5 = 243$, $\quad \ldots\ldots + 5\times(3)^4(-2x) = -810x \quad \ldots\ldots$ $+\frac{5\times 4}{2}(3)^3(-2x)^2 = \qquad +1080x^2$	B1, B1 M1 A1 (4) **[4]**
Notes	First term must be 243 for **B1**, writing just 3^5 is B0 (Mark their final answers except in second line of special cases below). Term must be simplified to $-810x$ for **B1** The x is required for this mark. The **method** mark **(M1)** is **generous** and is awarded for an attempt at Binomial to get the third term. There must be an x^2 (or no x- i.e. not wrong power) and attempt at Binomial Coefficient and at dealing with powers of 3 and 2. The power of 3 should not be one, but the power of 2 may be one (regarded as bracketing slip). So allow $\binom{5}{2}$ or $\binom{5}{3}$ or ${}^5C_2$ or ${}^5C_3$ or even $\left(\frac{5}{2}\right)$ or $\left(\frac{5}{3}\right)$ or use of '10' (maybe from Pascal's triangle) May see ${}^5C_2(3)^3(-2x)^2$ or ${}^5C_2(3)^3(-2x^2)$ or ${}^5C_2(3)^5(-\frac{2}{3}x^2)$ or $10(3)^3(2x)^2$ which would each score the **M1** **A1** is c.a.o and needs $1080x^2$ (if $1080x^2$ is written with no working this is awarded both marks i.e. **M1 A1.**)	
Special cases	$243+810x+1080x^2$ is **B1B0M1A1** (condone no negative signs) Follows correct answer with $27-90x+120x^2$ can isw here (sp case)– full marks for correct answer Misreads *ascending* and gives $-32x^5+240x^4-720x^3$ is marked as **B1B0M1A0** special case and must be completely correct. *(If any slips could get B0B0M1A0)* Ignores 3 and expands $(1\pm 2x)^5$ is **0/4** 243, -810x, 1080x^2 is full marks but 243, -810, 1080 is **B1,B0,M1,A0** NB Alternative method $3^5(1-\frac{2}{3}x)^5 = 3^5 - 5\times 3^5\times(\frac{2}{3}x)+\binom{5}{3}3^5\left(-\frac{2}{3}x\right)^2+..$ is **B0B0M1A0** – answers must be simplified to $243 -810x + 1080x^2$ for full marks (awarded as before) Special case $3(1-\frac{2}{3}x)^5 = 3-5\times 3\times(\frac{2}{3}x)+\binom{5}{3}3\left(-\frac{2}{3}x\right)^2+..$ is **B0, B0, M1, A0** Or $\quad 3(1-2x)^5$ is **B0B0M0A0**	

Question 10: June 09 Q2

Question Number	Scheme	Marks
(a)	$(7\times\ldots\times x)$ or $(21\times\ldots\times x^2)$ The 7 or 21 can be in 'unsimplified' form.	M1
	$(2+kx)^7 = 2^7 + 2^6\times 7\times kx + 2^5\times\binom{7}{2}k^2x^2$	
	$= 128;\quad +448kx,\quad +672k^2x^2$ [or $672(kx)^2$]	B1; A1, A1
	(If $672kx^2$ follows $672(kx)^2$, isw and allow A1)	(4)
(b)	$6\times 448k = 672k^2$	M1
	$k = 4$ (Ignore $k = 0$, if seen)	A1 (2) **[6]**

(a) The terms can be 'listed' rather than added. Ignore any extra terms.

M1 for either the x term or the x^2 term. Requires correct binomial coefficient in any form with the correct power of x, but the other part of the coefficient (perhaps including powers of 2 and/or k) may be wrong or missing.

Allow binomial coefficients such as $\binom{7}{1}$, $\left(\frac{7}{1}\right)$, $\binom{7}{2}$, ${}^7C_1$, ${}^7C_2$.

However, $448+kx$ or similar is M0.

B1, A1, A1 for the simplified versions seen above.

Alternative:

Note that a factor 2^7 can be taken out first: $2^7\left(1+\frac{kx}{2}\right)^7$, but the mark scheme still applies.

Ignoring subsequent working (isw):

Isw if necessary after correct working:

e.g. $128+448kx+672k^2x^2$ M1 B1 A1 A1

$= 4+14kx+21k^2x^2$ isw

(Full marks are still available in part (b)).

(b) M1 for equating their coefficient of x^2 to 6 times that of x… to get an equation in k,

… or equating their coefficient of x to 6 times that of x^2, to get an equation in k.

Allow this M mark even if the equation is trivial, providing their coefficients from part (a) have been used, e.g. $6\times 448k = 672k$, but beware $k = 4$ following from this, which is A0.

An equation in k alone is required for this M mark, so...

e.g. $6\times 448kx = 672k^2x^2 \Rightarrow k = 4$ or similar is M0 A0 (equation in coefficients only is never seen), but ...

e.g. $6\times 448kx = 672k^2x^2 \Rightarrow 6\times 448k = 672k^2 \Rightarrow k = 4$ will get M1 A1

(as coefficients rather than terms have now been considered).

The mistake $2\left(1+\frac{kx}{2}\right)^7$ would give a maximum of 3 marks: M1B0A0A0, M1A1

Question 11: Jan 10 Q1

Question Number	Scheme	Marks
	$\left[(3-x)^6=\right]3^6+3^5\times6\times(-x)+3^4\times\binom{6}{2}\times(-x)^2$ $=729,\quad -1458x,\quad +1215x^2$	M1 B1,A1, A1 **[4]**
Notes	**M1** for <u>either</u> the x term <u>or</u> the x^2 term. Requires <u>correct</u> binomial coefficient in any form with the correct power of x – condone lack of negative sign and wrong power of 3. This mark may be given if no working is shown, but one of the terms including x is correct. Allow $\frac{6}{1}$, or $\frac{6}{2}$ (must have a power of 3, even if only power 1) First term must be 729 for **B1**, (writing just 3^6 is **B0**) can isw if numbers added to this constant later. Can allow 729(1… Term must be simplified to $-1458x$ for **A1cao.** The x is required for this mark. **Final A1** is c.a.o and needs to be $+1215x^2$ (can follow omission of negative sign in working) Descending powers of x would be $x^6+3\times6\times(-x)^5+3^2\times\binom{6}{4}\times(-x)^4+..$ i.e. $x^6-18x^5+135x^4+..$ This is M1B1A0A0 if completely "correct" or M1 B0A0A0 for <u>correct</u> binomial coefficient in any form with the correct power of x as before	
Alternative	**NB Alternative method:** $(3-x)^6=3^6(1+6\times(-\frac{x}{3})+\binom{6}{2}\times(-\frac{x}{3})^2+..)$ is **M1B0A0A0** – answers must be simplified to 729, $-1458x$, $+1215x^2$ for full marks (awarded as before) The mistake $(3-x)^6=3(1-\frac{x}{3})^6=3(1+6\times(-\frac{x}{3})+\times\binom{6}{2}\times(-\frac{x}{3})^2+..)$ may also be awarded **M1B0A0A0** Another mistake $3^6(1-6x+15x^2...)=729...$ would be M1B1A0A0	

Question 12: June 10 Q4

Question Number	Scheme	Marks
	(a) $(1+ax)^7 = 1+7ax....$ or $1+7(ax)....$ (<u>Not</u> unsimplified versions)	B1
	$+\frac{7\times 6}{2}(ax)^2 + \frac{7\times 6\times 5}{6}(ax)^3$ Evidence from <u>one</u> of these terms is enough	M1
	$+21a^2x^2$ or $+21(ax)^2$ or $+21(a^2x^2)$	A1
	$+35a^3x^3$ or $+35(ax)^3$ or $+35(a^3x^3)$	A1
		(4)
	(b) $21a^2 = 525$	M1
	$a = \pm 5$ (Both values are required)	A1
	(The answer $a = 5$ with no working scores M1 A0)	(2)
		6

(a) The terms can be 'listed' rather than added.

M1: Requires correct structure: a correct binomial coefficient in any form (perhaps from Pascal's triangle) with the correct power of x. Allow missing a's and wrong powers of a, e.g.

$$\frac{7\times 6}{2}ax^2, \qquad \frac{7\times 6\times 5}{3\times 2}x^3$$

However, $21+a^2x^2+35+a^3x^3$ or similar is M0.

$1+7ax+21+a^2x^2+35+a^3x^3 = 57+.....$ scores the B1 (isw).

$\begin{pmatrix}7\\2\end{pmatrix}$ and $\begin{pmatrix}7\\3\end{pmatrix}$ or equivalent such as ${}^7C_2$ and ${}^7C_3$ are acceptable,

but <u>not</u> $\left(\frac{7}{2}\right)$ or $\left(\frac{7}{3}\right)$ (unless subsequently corrected).

1st A1: Correct x^2 term. 2nd A1: Correct x^3 term (The binomial coefficients <u>must</u> be simplified).

<u>Special case</u>:
If $(ax)^2$ and $(ax)^3$ are seen within the working, but then lost…
… A1 A0 can be given if $21ax^2$ and $35ax^3$ are <u>both</u> achieved.

<u>a's omitted throughout</u>:
Note that only the M mark is available in this case.

(b) M: Equating their coefficent of x^2 to 525.

An equation in a or a^2 alone is required for this M mark, but allow 'recovery' that shows <u>the required coefficient</u>, e.g.

$21a^2x^2 = 525 \Rightarrow 21a^2 = 525$ is acceptable,

but $21a^2x^2 = 525 \Rightarrow a^2 = 25$ is not acceptable.

After $21ax^2$ in the answer for (a), allow 'recovery' of a^2 in (b) so that full marks are available for (b) (but not retrospectively for (a)).

Question 13: Jan 11 Q5

Question Number	Scheme		Marks
(a)	$\binom{40}{4} = \frac{40!}{4!b!}$; $(1+x)^n$ coefficients of x^4 and x^5 are p and q respectively.		
	$b = 36$		B1
	Candidates should usually "identify" two terms as their p and q respectively.		(1)
(b)	Term 1: $\binom{40}{4}$ or ${}^{40}C_4$ or $\frac{40!}{4!36!}$ or $\frac{40(39)(38)(37)}{4!}$ or 91390	Any one of Term 1 or Term 2 correct. (Ignore the label of p and/or q.)	M1
	Term 2: $\binom{40}{5}$ or ${}^{40}C_5$ or $\frac{40!}{5!35!}$ or $\frac{40(39)(38)(37)(36)}{5!}$ or 658008	Both of them correct. (Ignore the label of p and/or q.)	A1
	Hence, $\frac{q}{p} = \frac{658008}{91390}\left\{= \frac{36}{5} = 7.2\right\}$	for $\frac{658008}{91390}$ oe	A1 oe cso
			(3) [4]
	Notes		
(a)	B1: for only $b = 36$.		
(b)	The candidate may expand out their binomial series. At this stage no marks should be awarded until they start to identify either one or both of the terms that they want to focus on. Once they identify their terms then if one out of two of them (ignoring which one is p and which one is q) is correct then award M1. If both of the terms are identified correctly (ignoring which one is p and which one is q) then award the first A1. Term 1 $= \binom{40}{4}x^4$ or ${}^{40}C_4(x^4)$ or $\frac{40!}{4!36!}x^4$ or $\frac{40(39)(38)(37)}{4!}x^4$ or $91390x^4$, Term 2 $= \binom{40}{5}x^5$ or ${}^{40}C_5(x^5)$ or $\frac{40!}{5!35!}x^5$ or $\frac{40(39)(38)(37)(36)}{5!}x^5$ or $658008x^5$ are fine for any (or both) of the first two marks in part (b). 2nd A1 for stating $\frac{q}{p}$ as $\frac{658008}{91390}$ or equivalent. Note that $\frac{q}{p}$ must be independent of x. Also note that $\frac{36}{5}$ or 7.2 or any equivalent fraction is fine for the 2nd A1 mark. SC: If candidate states $\frac{p}{q} = \frac{5}{36}$, then award M1A1A0. Note that either $\frac{4!36!}{5!35!}$ or $\frac{5!35!}{4!36!}$ would be awarded M1A1.		

Question 14: June11 Q2

Question Number	Scheme		Marks
(a)	$\left\{(3+bx)^5\right\} = (3)^5 + \underline{{}^5C_1(3)^4(b\underline{x})} + \underline{{}^5C_2(3)^3(b\underline{x})^2} + \ldots$	243 as a constant term seen.	B1
	$= 243 + 405bx + 270b^2x^2 + \ldots$	$405bx$	B1
		$\left({}^5C_1 \times \ldots \times x\right)$ or $\left({}^5C_2 \times \ldots \times x^2\right)$	M1
		$270b^2x^2$ or $270(bx)^2$	A1 **[4]**
(b)	$\left\{2(\text{coeff } x) = \text{coeff } x^2\right\} \Rightarrow 2(405b) = 270b^2$	Establishes an equation from their coefficients. Condone 2 on the wrong side of the equation.	M1
	So, $\left\{b = \dfrac{810}{270} \Rightarrow\right\} b = 3$	$b = 3$ (Ignore $b = 0$, if seen.)	A1
			[2] 6

(a)

The terms can be "listed" rather than added. Ignore any extra terms.

1st B1: A constant term of 243 seen. Just writing $(3)^5$ is B0.

2nd B1: Term must be simplified to $405bx$ for B1. The x is required for this mark. Note $405 + bx$ is B0.

M1: For <u>either</u> the x term <u>or</u> the x^2 term. Requires <u>correct</u> binomial coefficient in any form <u>with the correct power of x</u>, but the other part of the coefficient (perhaps including powers of 3 and/or b) may be wrong or missing.

<u>Allow</u> binomial coefficients such as $\binom{5}{2}, \left(\frac{5}{2}\right), \binom{5}{1}, \left(\frac{5}{1}\right), {}^5C_2, {}^5C_1$.

A1: For either $270b^2x^2$ or $270(bx)^2$. (If $270bx^2$ follows $270(bx)^2$, isw and allow A1.)

<u>Alternative:</u>

Note that a factor of 3^5 can be taken out first: $3^5\left(1+\dfrac{bx}{3}\right)^5$, but the mark scheme still applies.

<u>Ignore subsequent working (isw)</u>: Isw if necessary after correct working:

e.g. $243 + 405bx + 270b^2x^2 + \ldots$ leading to $9 + 15bx + 10b^2x^2 + \ldots$ scores B1B1M1A1 isw.

Also note that full marks could also be available in part (b), here.

<u>Special Case</u>: Candidate writing down the first three terms in ***descending*** powers of x usually get $(bx)^5 + {}^5C_4(3)^1(bx)^4 + {}^5C_3(3)^2(bx)^3 + \ldots = b^5x^5 + 15b^4x^4 + 90b^3x^3 + \ldots$

So award SC: B0B0M1A0 for either $\left({}^5C_4 \times \ldots \times x^4\right)$ or $\left({}^5C_3 \times \ldots \times x^3\right)$

<u>or</u> equating their coefficient of x to 2 times that of x^2, to get an equation in b.

Allow this M mark even if the equation is trivial, providing their coefficients from part (a) have been used, eg: $2(405b) = 270b$, but beware $b = 3$ from this, which is A0.

<u>An equation in b alone</u> is required:

e.g. $2(405b)x = 270b^2x^2 \Rightarrow b = 3$ or similar will be **Special Case** SC: M1A0 (as equation in coefficients only is not seen here).

e.g. $2(405b)x = 270b^2x^2 \Rightarrow 2(405b) = 270b^2 \Rightarrow b = 3$ will get M1A1 (as coefficients rather than terms have now been considered).

Note: Answer of 3 from no working scores M1A0.

Note: The mistake $k\left(1+\dfrac{bx}{3}\right)^5, k \neq 243$ would give a maximum of 3 marks: B0B0M1A0, M1A1

Note: For $270bx^2$ in part (a), followed by $2(405b) = 270b^2 \Rightarrow b = 3$, in part (b), allow recovery M1A1.