1 (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 $448a^5 = 3402 \Rightarrow a^5 = \frac{243}{32}$	M1	1.1b
	$\Rightarrow a = \frac{3}{2}$	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 $\Rightarrow a^k = \ldots$ where $k \in \mathbb{N}$ $k \neq 1$

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

(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
2(a)	3^8 or 6561 as the constant term	B1	1.1b
	$\left(3-\frac{2x}{9}\right)^8 = ...+{}^8C_1(3)^7\left(-\frac{2x}{9}\right)+{}^8C_2(3)^6\left(-\frac{2x}{9}\right)^2+{}^8C_3(3)^5\left(-\frac{2x}{9}\right)^3+...$ $=...+8\times(3)^7\left(-\frac{2x}{9}\right)+28\times(3)^6\left(-\frac{2x}{9}\right)^2+56(3)^5\left(-\frac{2x}{9}\right)^3$	M1 A1	1.1b 1.1b
	$=6561-3888x+1008x^2-\frac{448}{3}x^3+...$	A1	1.1b
		(4)	
(b)	Coefficient of x^2 is $\frac{1}{2}\times\text{"}1008\text{"}-\frac{1}{2}\times\text{"}-\frac{448}{3}\text{"}$	M1	3.1a
	$=\frac{1736}{3}$ (or $578\frac{2}{3}$)	A1	1.1b
		(2)	
		(6 marks)	

Notes

(a)

B1: Sight of 3^8 or 6561 as the constant term.

M1: An attempt at the binomial expansion. This can be awarded for the correct structure of the 2nd, 3rd or 4th term. The correct binomial coefficient must be associated with the correct power of 3 and the correct power of $(\pm)\frac{2x}{9}$. Condone invisible brackets

eg ${}^8C_2(3)^6-\frac{2x}{9}^2$ for this mark.

A1: For a correct simplified or unsimplified **second** or **fourth term** (with binomial coefficients evaluated).

$+8\times(3)^7\left(-\frac{2x}{9}\right)$ or $+56(3)^5\left(-\frac{2x}{9}\right)^3$

A1: $6561-3888x+1008x^2-\frac{448}{3}x^3$ Ignore any extra terms and allow the terms to be listed.

Allow the exact equivalent to $-\frac{448}{3}$ eg $-149.\dot{3}$ but not -149.3.

Condone x^1 and eg $+-3888x$. Do not isw if they multiply all the terms by eg 3

Alt(a)

B1: Sight of $3^8(1+.....)$ or 6561 as the constant term

M1: An attempt at the binomial expansion $\left(1-\frac{2}{27}x\right)^8$. This can be awarded for the correct structure of the 2nd, 3rd or 4th term. The correct binomial coefficient must be associated with the correct power of $(\pm)\frac{2x}{27}$. Condone invisible brackets for this mark.

Score for any of:

$8\times-\frac{2}{27}x,\ \frac{8\times7}{2}\times\left(-\frac{2}{27}x\right)^2,\ \frac{8\times7\times6}{6}\times\left(-\frac{2}{27}x\right)^3$ which may be implied by any of

$-\frac{16}{27}x,\ +\frac{112}{729}x^2,\ -\frac{448}{19683}x^3$

A1: For a correct simplified or unsimplified **second** or **fourth** term including being multiplied by 3^8

A1: $6561-3888x+1008x^2-\frac{448}{3}x^3$ Ignore any extra terms and allow the terms to be listed.

Allow the exact equivalent to $-\frac{448}{3}$ eg $-149.\dot{3}$ but not -149.3.

Condone x^1 and eg $+-3888x$

(b)

M1: Adopts a correct strategy for the required coefficient. This requires an attempt to calculate $\pm\frac{1}{2}$ their coefficient of x^2 from part (a) $\pm\frac{1}{2}$ their coefficient of x^3 from part (a).

There must be an attempt to bring these terms together to a single value. ie they cannot just circle the relevant terms in the expansion for this mark. The strategy may be implied by their answer.

Condone any appearance of x^2 or x^3 appearing in their intermediate working.

A1: $\frac{1736}{3}$ or $578\frac{2}{3}$ Do not accept $578.\dot{6}$ or $\frac{1736}{3}x^2$

Question	Scheme	Marks	AOs
3	Attempts the term in x^3 or the term in x^5 of $\left(3-\frac{1}{2}x\right)^6$ Look for ${}^6C_3 3^3\left(-\frac{1}{2}x\right)^3$ or ${}^6C_5 3^1\left(-\frac{1}{2}x\right)^5$	M1	3.1a
	Correct term in x^3 or correct term in x^5 of $\left(3-\frac{1}{2}x\right)^6$ $-\frac{135}{2}x^3$ **or** $-\frac{9}{16}x^5$	A1	1.1b
	Attempts one of the required terms in x^5 of $(5+8x^2)\left(3-\frac{1}{2}x\right)^6$ Either $5\times{}^6C_5 3^1\left(-\frac{1}{2}x\right)^5$ **or** $8x^2\times{}^6C_3 3^3\left(-\frac{1}{2}x\right)^3$	M1	1.1b
	Attempts the sum of $5\times{}^6C_5 3^1\left(-\frac{1}{2}x\right)^5$ and $8x^2\times{}^6C_3 3^3\left(-\frac{1}{2}x\right)^3$	dM1	2.1
	Coefficient of x^5 $=-\frac{45}{16}-540=-\frac{8685}{16}$	A1	1.1b
		(5)	
		(5 marks)	

Notes:

M1: For the key step in attempting to find one of the required terms in the expansion of $\left(3-\frac{1}{2}x\right)^6$ to enable the problem to be solved.

Look for ${}^6C_3 3^3\left(-\frac{1}{2}x\right)^3$ **or** ${}^6C_5 3^1\left(-\frac{1}{2}x\right)^5$ but condone missing brackets and slips in signs.

May be part of a complete expansion but only one of the required terms needs to be of the correct form.

A1: For $-\frac{135}{2}\{x^3\}$ **or** $-\frac{9}{16}\{x^5\}$ which may be unsimplified but the ${}^6C_3$ or ${}^6C_5$ must be processed. May be implied by $-540\{x^5\}$ **or** $-\frac{45}{16}\{x^5\}$

M1: Attempts one of the required terms in x^5 of the expansion of $(5+8x^2)\left(3-\frac{1}{2}x\right)^6$

Look for $5\times{}^6C_5 3^1\left(-\frac{1}{2}x\right)^5$ **or** $8x^2\times{}^6C_3 3^3\left(-\frac{1}{2}x\right)^3$ which would also imply the previous M.

The x^5 may be missing as just the coefficient is required.

May be implied by $-540\{x^5\}$ **or** $-\frac{45}{16}\{x^5\}$

Condone missing brackets and signs.

You might see candidates make a slip in, e.g., their binomial coefficients, but have an (essentially) correct method to solve the problem.

Note that this M mark is not dependent on the first, so you may be able to award it even if they have made a slip in finding their x^3 or x^5 term in the expansion.

dM1: Attempts the sum of $5\times {}^6C_5 3^1\left(-\frac{1}{2}x\right)^5$ and $8x^2\times {}^6C_3 3^3\left(-\frac{1}{2}x\right)^3$

Dependent on the previous M but may be scored at the same time.

The x^5 may be missing as just the coefficients are required.
Condone missing brackets and signs.

A1: $-\frac{8685}{16}$ or exact equivalent, -542.8125 and apply isw

Condone $-\frac{8685}{16}x^5$ for A1

Note that rounded decimals, e.g., -542.81 will not score the last mark.

Note that full marks can be scored for concise solutions such as:

$$5\times {}^6C_5\times 3\times\left(-\frac{1}{2}\right)^5 + 8\times {}^6C_3\times 3^3\times\left(-\frac{1}{2}\right)^3 = -\frac{8685}{16}$$

Alternative
Attempts via the taking out of the common factor can be scored in the same way.

$$\left(3-\frac{1}{2}x\right)^6 = 3^6\left\{1+6\times\left(-\frac{1}{6}x\right)^1+\frac{6\times5}{2}\left(-\frac{1}{6}x\right)^2+\frac{6\times5\times4}{3!}\left(-\frac{1}{6}x\right)^3+\frac{6\times5\times4\times3}{4!}\left(-\frac{1}{6}x\right)^4+\frac{6\times5\times4\times3\times2}{5!}\left(-\frac{1}{6}x\right)^5+\left(-\frac{1}{6}x\right)^6\right\}$$

For M1 A1 look for $3^6\times\frac{6\times5\times4}{3!}\left(-\frac{1}{6}x\right)^3$ **or** $3^6\times\frac{6\times5\times4\times3\times2}{5!}\left(-\frac{1}{6}x\right)^5$

Score the remaining marks as per the main scheme.