	(8a = 10) $a = \frac{5}{4} = 1\frac{1}{4}$ (equivalent single fraction or 1.25)	A1 (2)
(c)	Substituting their values of a and r into **correct** formula for sum.	M1
	$S = \frac{a(r^n - 1)}{r-1} = \frac{5}{4}(2^{20} - 1)$ (= 1310718.75) 1 310 719 (only this)	A1 (2) **[6]**
Notes:	(a) M1: Condone errors in powers, e.g. ar^4 = 10 and/or ar^7 = 80, A1: For r = 2, allow even if ar^4 = 10 and ar^7 = 80 used (just these) (M mark can be implied from numerical work, if used correctly) (b) M1: Allow for numerical approach: e.g. $\frac{10}{r_c^{\ 3}} \leftarrow \frac{10}{r_c^{\ 2}} \leftarrow \frac{10}{r_c} \leftarrow 10$ In (a) and (b) correct answer, with no working, allow both marks. (c) Attempt 20 terms of series and add is M1 (correct last term 655360) If formula **not** quoted, errors in applying their a and/or r is M0 Allow full marks for correct answer with no working seen.	
3. (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. (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 for 1 + 5x (b) For M1: Substituting their (0.01) into their (a) result 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)	

June 2008
Core Mathematics C2
Mark Scheme

Question number	Scheme	Marks
3.	(a) $(1+ax)^{10} = 1 + 10ax......$ (<u>Not</u> unsimplified versions) $+\frac{10\times 9}{2}(ax)^2 + \frac{10\times 9\times 8}{6}(ax)^3$ Evidence from <u>one</u> of these terms is sufficient $+45(ax)^2,\ +120(ax)^3$ or $+45a^2x^2,\ +120a^3x^3$ (b) $120a^3 = 2\times 45a^2$ $a = \frac{3}{4}$ or equiv. $\left(\text{e.g.} \frac{90}{120}, 0.75\right)$ Ignore $a = 0$, if seen	B1 M1 A1, A1 (4) M1 A1 (2) **6**
	(a) The terms can be 'listed' rather than added. M1: Requires correct structure: 'binomial coefficient' (perhaps from Pascal's triangle) and the correct power of x. (The M mark can also be given for an expansion in <u>descending</u> powers of x). Allow 'slips' such as: $\frac{10\times 9}{2}ax^2,\quad \frac{10\times 9}{3\times 2}(ax)^3,\quad \frac{10\times 9}{2}x^2,\quad \frac{9\times 8\times 7}{3\times 2}a^3x^3$ However, $45 + a^2x^2 + 120 + a^3x^3$ or similar is M0. $\binom{10}{2}$ and $\binom{10}{3}$ or equivalent such as ${}^{10}C_2$ and ${}^{10}C_3$ are acceptable, and even $\left(\frac{10}{2}\right)$ and $\left(\frac{10}{3}\right)$ are acceptable for the method mark. 1st A1: Correct x^2 term. 2nd A1: Correct x^3 term (These <u>must</u> be simplified). If simplification is not seen in (a), but correct simplified terms are seen in (b), these marks can be awarded. However, if <u>wrong</u> simplification is seen in (a), this takes precedence. <u>Special case</u>: If $(ax)^2$ and $(ax)^3$ are seen within the working, but then lost… … A1 A0 can be given if $45ax^2$ and $120ax^3$ are <u>both</u> achieved. (b) M: Equating their coefficent of x^3 to twice their coefficient of x^2 … … <u>or</u> equating their coefficent of x^2 to twice their coefficient of x^3. (… or coefficients can be <u>correct</u> coefficients rather than their coefficients). Allow this mark even if the equation is trivial, e.g. $120a = 90a$. An equation in a alone is required for this M mark, although… …condone, e.g. $120a^3x^3 = 90a^2x^2 \Rightarrow (120a^3 = 90a^2 \Rightarrow)\ a = \frac{3}{4}$. <u>Beware</u>: $a = \frac{3}{4}$ following $120a = 90a$, which is A0.	

January 2009
6664 Core Mathematics C2
Mark Scheme

<table>
<tr><th>Question Number</th><th>Scheme</th><th>Marks</th></tr>
<tr><td>1</td><td>$(3-2x)^5 = 243$, $\ldots\ldots + 5\times(3)^4(-2x) = -810x \quad \ldots\ldots$

$+\frac{5\times 4}{2}(3)^3(-2x)^2 = \qquad +1080x^2$</td><td>B1, B1

M1 A1 (4)

[4]</td></tr>
<tr><td>Notes</td><td colspan="2">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 $\begin{pmatrix}5\\2\end{pmatrix}$ or $\begin{pmatrix}5\\3\end{pmatrix}$ 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.)</td></tr>
<tr><td>Special cases</td><td colspan="2">$243+810x+1080x^2$ 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 $3^5(1-\frac{2}{3}x)^5 = 3^5 - 5\times 3^5\times\left(\frac{2}{3}x\right)+\begin{pmatrix}5\\3\end{pmatrix}3^5\left(-\frac{2}{3}x\right)^2+..$ is B0B0M1A0
– answers must be simplified to 243 $-810x$ $+1080x^2$ for full marks (awarded as before)
Special case $3(1-\frac{2}{3}x)^5 = 3-5\times 3\times\left(\frac{2}{3}x\right)+\begin{pmatrix}5\\3\end{pmatrix}3\left(-\frac{2}{3}x\right)^2+..$ is B0, B0, M1, A0
Or $3(1-2x)^5$ is B0B0M0A0</td></tr>
</table>

Question Number	Scheme	Marks
Q2 (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 $672(kx)^2$] (If $672kx^2$ follows $672(kx)^2$, isw and allow A1)	B1; A1, 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 <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 2 and/or k) may be wrong or missing.

<u>Allow</u> 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 <u>simplified</u> versions seen above.

<u>Alternative</u>:

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.

<u>Ignoring subsequent working (isw)</u>:

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,

… <u>or</u> 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.

<u>An equation in k alone</u> 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 edexcel

January 2010
Core Mathematics C2 6664
Mark Scheme

Question Number	Scheme	Marks
Q1	$\left[(3-x)^6 =\right] 3^6 + 3^5 \times 6 \times (-x) + 3^4 \times \binom{6}{2} \times (-x)^2$ $= 729, \quad -1458x, \quad +1215x^2$	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 $x^6 + 3 \times 6 \times (-x)^5 + 3^2 \times \binom{6}{4} \times (-x)^4 + ..$ 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 Number	Scheme	Marks
4	(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. $\frac{7\times 6}{2}ax^2$, $\frac{7\times 6\times 5}{3\times 2}x^3$ 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). $\binom{7}{2}$ and $\binom{7}{3}$ 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)).	