advancing learning, changing lives

Mark Scheme (Results)
Summer 2010

GCE

Core Mathematics C1 (6663)

Edexcel Limited. Registered in England and Wales No. 4496750
Registered Office: One90 High Holborn, London WC1V 7BH

A PEARSON COMPANY

If you have any subject specific questions about the content of this Mark Scheme that require the help of a subject specialist, you may find our Ask The Expert email service helpful.

Ask The Expert can be accessed online at the following link:

http://www.edexcel.com/Aboutus/contact-us/

Summer 2010

Publications Code UA023696

SOME GENERAL PRINCIPLES FOR C1 MARKING
(But the particular mark scheme always takes precedence)

Method marks

Usually we would overlook simple arithmetic errors or sign slips but the correct **processes** should be used. So dividing by a number instead of subtracting would be M0 but adding a number instead of subtracting would be treated as the correct process but a sign error.

Method mark for solving 3 term quadratic:

1. Factorisation

$(x^2+bx+c)=(x+p)(x+q),\ \text{where}\ |pq|=|c|$, leading to *x* = ...

$(ax^2+bx+c)=(mx+p)(nx+q),\ \text{where}\ |pq|=|c|\ \text{and}\ |mn|=|a|$, leading to *x* = ...

2. Formula

Attempt to use correct formula (with values for *a*, *b* and *c*).

3. Completing the square

Solving $x^2+bx+c=0$: $\left(x\pm\frac{b}{2}\right)^2 \pm q \pm c = 0,\quad q\neq 0$, leading to *x* = ...

Use of a formula

Where a method involves using a formula that has been learnt, the advice given in recent examiners' reports is that the formula should be quoted first.

Normal marking procedure is as follows:

Method mark for quoting a correct formula and attempting to use it, even if there are mistakes in the substitution of values (but refer to the mark scheme first… the application of this principle may vary).

Where the formula is not quoted, the method mark can be gained by implication from correct working with values, but will be lost if there is any mistake in the working.

Equation of a straight line

Apply the following conditions to the M mark for the equation of a line through (a,b):

If the *a* and *b* are the wrong way round the M mark can still be given if a correct formula is seen, (e.g. $y-y_1=m(x-x_1)$) otherwise M0.

If (*a*, *b*) is substituted into $y=mx+c$ to find *c*, the M mark is for attempting this and scored when *c* =... is reached.

Answers without working

The rubric says that these may gain no credit. Individual mark schemes will give details of what happens in particular cases. General policy is that if it could be done "in your head", detailed working would not be required. Most candidates do show working, but there are occasional awkward cases and if the mark scheme does not cover this, please contact your team leader for advice.

Misreads

A misread must be consistent for the whole question to be interpreted as such.

These are not common. In clear cases, please deduct the first 2 A (or B) marks which would have been lost by following the scheme. (Note that 2 marks is the maximum misread penalty, but that misreads which alter the nature or difficulty of the question cannot be treated so generously and it will usually be necessary here to follow the scheme as written).

Sometimes following the scheme as written is more generous to the candidate than applying the misread rule, so in this case use the scheme as written.

If in doubt, send the response to Review.

June 2010
Core Mathematics C1 6663
Mark Scheme

Question Number	Scheme	Marks
1.	$\left(\sqrt{75}-\sqrt{27}\right)=5\sqrt{3}-3\sqrt{3}$	M1
	$=2\sqrt{3}$	A1
		2
	Notes	
	M1 for $5\sqrt{3}$ from $\sqrt{75}$ or $3\sqrt{3}$ from $\sqrt{27}$ seen anywhere A1 for $2\sqrt{3}$; allow $\sqrt{12}$ or $k=2, x=3$ or allow $k=1, x=12$ Some Common errors $\sqrt{75}-\sqrt{27}=\sqrt{48}$ leading to $4\sqrt{3}$ is M0A0 $25\sqrt{3}-9\sqrt{3}=16\sqrt{3}$ is M0A0	

Question Number	Scheme	Marks
2.	$\frac{8x^4}{4}+\frac{6x^{\frac{3}{2}}}{\frac{3}{2}}-5x+c$	M1 A1
	$= 2x^4+4x^{\frac{3}{2}},-5x+c$	A1 A1
		4
	Notes	
	M1 for some attempt to integrate a term in x: $x^n \to x^{n+1}$ 1st A1 for correct, possibly un-simplified x^4 or $x^{\frac{3}{2}}$ term. e.g. $\frac{8x^4}{4}$ or $\frac{6x^{\frac{3}{2}}}{\frac{3}{2}}$ 2nd A1 for <u>both</u> $2x^4$ and $4x^{\frac{3}{2}}$ terms correct and simplified on the same line N.B. some candidates write $4\sqrt{x^3}$ or $4x^{1\frac{1}{2}}$ which are, of course, fine for A1 3rd A1 for $-5x+c$. Accept $-5x^1+c$. The $+c$ must appear on the same line as the $-5x$ N.B. We do not need to see one line with a fully correct integral Ignore ISW (ignore incorrect subsequent working) if a correct answer is followed by an incorrect version. Condone poor use of notation e.g. $\int 2x^4+4x^{\frac{3}{2}}-5x+c$ will score full marks.	

Question Number	Scheme	Marks
3. **(a)**	$3x-6<8-2x \rightarrow \quad 5x<14$ (Accept $5x-14<0$ (o.e.))	M1
	$x<2.8$ or $\frac{14}{5}$ or $2\frac{4}{5}$ (condone $\leq$)	A1 (2)
(b)	Critical values are $x=\frac{7}{2}$ and -1	B1
	Choosing "inside" $-1<x<\frac{7}{2}$	M1 A1 (3)
(c)	$-1<x<2.8$	B1ft (1)
	Accept any exact equivalents to -1, 2.8, 3.5	**6**
	<u>Notes</u>	

(a) M1 for attempt to rearrange to $kx < m$ (o.e.) Either $k = 5$ or $m = 14$ should be correct
Allow $5x = 14$ or even $5x > 14$

(b) B1 for both correct critical values. (May be implied by a correct inequality)
M1 ft their values and choose the "inside" region
A1 for fully correct inequality (Must be in part (b): do not give marks if only seen in (c))
Condone seeing $x < -1$ in working provided $-1 < x$ is in the final answer.

e.g. $x>-1,\ x<\frac{7}{2}$ <u>or</u> $x>-1$ "or" $x<\frac{7}{2}$ <u>or</u> $x>-1$ "blank space" $x<\frac{7}{2}$ score M1A0

BUT allow $x>-1$ and $x<\frac{7}{2}$ to score M1A1 (the "and" must be seen)

Also $\left(-1,\frac{7}{2}\right)$ will score M1A1

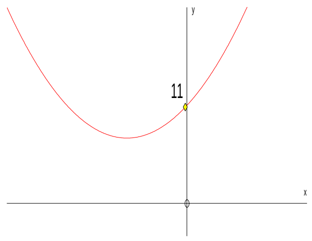
NB $x<-1, x<\frac{7}{2}$ is of course M0A0 and a number line even with "open" ends is M0A0

Allow 3.5 instead of $\frac{7}{2}$

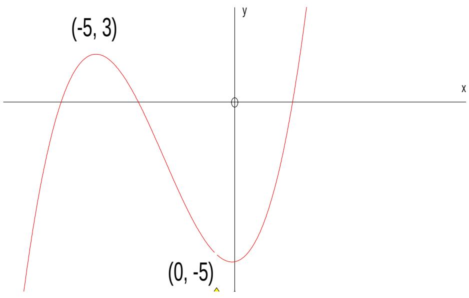
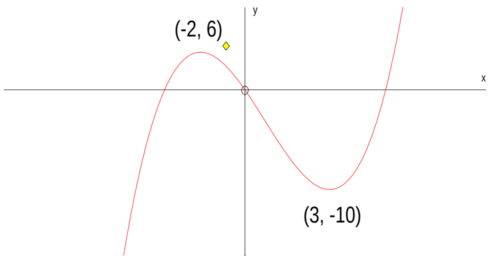
(c) B1ft for $-1<x<2.8$ (ignoring their previous answers) <u>or</u> ft their answers to part (a) and part (b) provided both answers were regions and not single values.
Allow use of "and" between inequalities as in part (b)
If their set is empty allow a suitable description in words or the symbol $\varnothing$.

<u>Common error:</u> If (a) is correct and in (b) they simply leave their answer as $x<-1$, $x < 3.5$ then in (c) $x < -1$ would get B1ft as this is a correct follow through of these 3 inequalities.

Penalise use of $\leq$ only on the A1 in part (b). [i.e. condone in part (a)]

Question Number	Scheme	Marks
4. **(a)**	$(x+3)^2+2$ or $p=3$ or $\frac{6}{2}$	B1
	$q=2$	B1 (2)
(b)		
	U shape with min in 2^{nd} quad (Must be above *x*-axis and not on *y*=axis)	B1
	U shape crossing *y*-axis at (0, 11) only (Condone (11,0) marked on *y*-axis)	B1 (2)
(c)	$b^2-4ac=6^2-4\times11$	M1
	$=\underline{-8}$	A1 (2) **6**
	Notes	
(a)	Ignore an "= 0" so $(x+3)^2+2=0$ can score both marks	
(b)	The U shape can be interpreted fairly generously. Penalise an obvious V on 1st B1 only. The U needn't have equal "arms" as long as there is a clear min that "holds water" 1st B1 for U shape with minimum in 2^{nd} quad. Curve need not cross the *y*-axis but minimum should NOT touch *x*-axis and should be left of (not on) *y*-axis 2nd B1 for U shaped curve crossing at (0, 11). Just 11 marked on *y*-axis is fine. The point must be marked on the sketch (do not allow from a table of values) Condone stopping at (0, 11)	
(c)	M1 for some correct substitution into b^2-4ac. This may be as part of the quadratic formula but must be in part (c) and must be only numbers (no *x* terms present). Substitution into $b^2<4ac$ or $b^2=4ac$ or $b^2>4ac$ is M0 A1 for -8 only. If they write $-8<0$ treat the <0 as ISW and award A1 If they write $-8\geq0$ then score A0 A substitution in the quadratic formula leading to -8 inside the square root is A0. So substituting into $b^2-4ac<0$ leading to $-8<0$ can score M1A1. Only award marks for use of the discriminant in part (c)	

Question Number	Scheme	Marks
5.		
(a)	$a_2 = \left(\sqrt{4+3}\right) = \sqrt{7}$	B1
	$a_3 = \sqrt{\text{"their 7"}+3} = \sqrt{10}$	B1ft (2)
(b)	$a_4 = \sqrt{10+3}\left(=\sqrt{13}\right)$	M1
	$a_5 = \sqrt{13+3} = 4$ *	A1 cso (2)
		4
	Notes	
(a)	1st B1 for $\sqrt{7}$ only 2nd B1ft follow through their "7" in correct formula provided they have $\sqrt{n}$,where n is an integer.	
(b)	M1 for an attempt to find a_4. Should see $\sqrt{\text{"their"}(a_3)^2+3}$. Must see evidence for M1. $a_4 = \sqrt{13}$ provided this follows from their a_3 working or answer is sufficient A1cso for a correct solution (M1 explicit) must include the = 4. Ending at $\sqrt{16}$ only is A0 and ending with $\pm$ 4 is A0. Ignore any incorrect statements that are not used e.g. common difference = $\sqrt{3}$ Listing: A full list: 2 $\left(=\sqrt{4}\right)$, $\sqrt{7}$, $\sqrt{10}$, $\sqrt{13}$, $\sqrt{16}=4$ is fine for M1A1	
ALT	Formula: Some may state (or use) $a_n = \sqrt{3n+1}$ leading to $a_5 = \sqrt{3\times5+1} = 4$. This will get marks in (a) [if correct values are seen] and can score the M1 in (b) if $a_n = \sqrt{3n+1}$ or $a_4 = \sqrt{13}$ are seen.	
$\pm\sqrt{\ }$	If $\pm\sqrt{\ }$ appear any where ignore in part (a) and withhold the final A mark only	

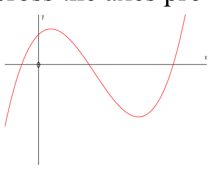
Question Number	Scheme		Marks	
6.				
(a)		Horizontal translation of ± 3	M1	
		$(-5, 3)$ marked on sketch **or in text**	B1	
		$(0, -5)$ and min intentionally on y-axis Condone $(-5, 0)$ if correctly placed on negative y-axis	A1	(3)
(b)		Correct shape and intentionally through (0,0) between the max and min	B1	
		$(-2, 6)$ marked on graph **or in text**	B1	
		$(3, -10)$ marked on graph **or in text**	B1	(3)
(c)	$(a =)$ <u>5</u>		B1	(1)

<u>Notes</u>

Turning points (not on axes) should have both co-ordinates given in form(x,y) .
Do not accept points marked on axes e.g. -5on x-axis and 3 on y-axis is not sufficient.
For repeated offenders apply this penalty **once only** at first offence and condone elsewhere.

In (a) and (b) no graphs means no marks.

In (a) and (b) the ends of the graphs do not need to cross the axes provided max and min are clear

(a) M1 for a horizontal translation of ± 3 so accept  i.e max in 1^{st} quad <u>and</u> coordinates of $(1, 3)$ <u>or</u> $(6, -5)$ seen.
[Horizontal translation to the left should have a min <u>on</u> the y-axis]
If curve passes through (0,0) then M0 (and A0) but they could score the B1 mark.

A1 for minimum clearly on negative y-axis and at least -5 marked on y-axis.
Allow this mark if the minimum is very close and the point $(0, -5)$ clearly indicated

(b) 1^{st} B1 Ignore coordinates for this mark
Coordinates or points on sketch override coordinates given in the text.
Condone (y, x) confusion for points on axes only. So $(-5,0)$ for $(0, -5)$ is OK if the point is marked correctly but $(3,10)$ is B0 even if in 4^{th} quadrant.

(c) **This may be at the bottom of a page or in the question...make sure you scroll up and down!**

Question Number	Scheme	Marks
7.	$\dfrac{3x^2+2}{x} = 3x + 2x^{-1}$	M1 A1
	$(y' =) 24x^2, -2x^{-\frac{1}{2}}, +3 - 2x^{-2}$	M1 A1 A1A1
	$\left[24x^2 - 2x^{-\frac{1}{2}} + 3 - 2x^{-2}\right]$	**6**

Notes

1st M1 for attempting to divide(one term correct)

1st A1 for both terms correct on the same line, accept $3x^1$ for $3x$ or $\dfrac{2}{x}$ for $2x^{-1}$

These first two marks may be implied by a correct differentiation at the end.

2nd M1 for an attempt to differentiate $x^n \to x^{n-1}$ for at least one term of their expression

"Differentiating" $\dfrac{3x^2+2}{x}$ and getting $\dfrac{6x}{1}$ is M0

2nd A1 for $24x^2$ only

3rd A1 for $-2x^{-\frac{1}{2}}$ allow $\dfrac{-2}{\sqrt{x}}$. Must be simplified to this, not e.g. $\dfrac{-4}{2}x^{-\frac{1}{2}}$

4th A1 for $3-2x^{-2}$ allow $\dfrac{-2}{x^2}$. Both terms needed. Condone $3+(-2)x^{-2}$

If "$+c$" is included then they lose this final mark

They do not need one line with all terms correct for full marks.
Award marks when first seen in this question and apply ISW.

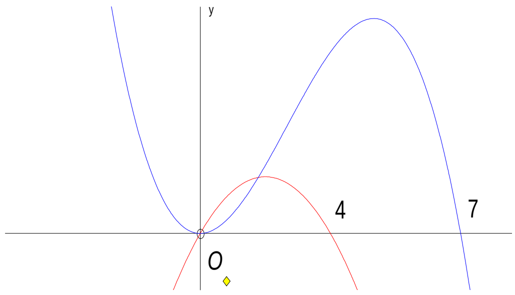
Condone a mixed line of some differentiation and some division
e.g. $24x^2 - 4x^{\frac{1}{2}} + 3x + 2x^{-1}$ can score 1st M1A1 and 2nd M1A1

Quotient /Product Rule	$\dfrac{x(6x)-(3x^2+2)\times 1}{x^2}$ or $6x(x^{-1})+(3x^2+2)(-x^{-2})$ $\dfrac{3x^2-2}{x^2}$ or $3-\dfrac{2}{x^2}$ (o.e.)	1st M1 for an attempt: $\frac{P-Q}{x^2}$ or $R+(-S)$ with one of P,Q or R,S correct. 1st A1 for a correct expression 4th A1 same rules as above

Question Number	Scheme	Marks	
8.			
(a)	$m_{AB} = \frac{4-0}{7-2}$ $\left(= \frac{4}{5}\right)$	M1	
	Equation of *AB* is: $y - 0 = \frac{4}{5}(x-2)$ or $y - 4 = \frac{4}{5}(x-7)$ (o.e.)	M1	
	$\underline{4x - 5y - 8 = 0}$ (o.e.)	A1	(3)
(b)	$(AB =)\sqrt{(7-2)^2 + (4-0)^2}$	M1	
	$= \sqrt{41}$	A1	(2)
(c)	Using isos triangle with $AB = AC$ then $t = 2 \times y_A = 2 \times 4 = 8$	B1	(1)
(d)	Area of triangle = $\frac{1}{2}t \times (7-2)$	M1	
	$= \underline{20}$	A1	(2)
			8

	Notes
	Apply the usual rules for quoting formulae here. For a correctly quoted formula with some correct substitution award M1. If no formula is quoted then a fully correct expression is needed for the M mark
(a)	1st M1 for attempt at gradient of *AB*. Some correct substitution in correct formula.
	2nd M1 for an attempt at equation of *AB*. Follow through their gradient, not e.g. $-\frac{1}{m}$ Using $y = mx + c$ scores this mark when c is found.
	Use of $\frac{y - y_1}{y_2 - y_1} = \frac{x - x_1}{x_2 - x_1}$ scores 1st M1 for denominator, 2nd M1 for use of a correct point
	A1 requires integer form but allow $5y + 8 = 4x$ etc. Must have an "=" or A0
(b)	M1 for an expression for *AB* or AB^2. Ignore what is "left" of the equals sign
(c)	B1 for $t = 8$. May be implied by correct coordinates (2, 8) or the value appearing in (d)
(d)	M1 for an expression for the area of the triangle, follow through their t ($\neq 0$) but must have the $(7-2)$ or 5 and the $\frac{1}{2}$.
DET	e.g. $\begin{matrix} 2 & 7 & 2 & 2 \\ 0 & 4 & t & 0 \end{matrix}$ Area $= \frac{1}{2}\left[8 + 7t + 0 - (0 + 8 + 2t)\right]$ Must have the $\frac{1}{2}$ for M1

Question Number	Scheme	Marks
9. **(a)**	$a + 29d = 40.75$ or $a = 40.75 - 29d$ or $29d = 40.75 - a$	M1 A1 (2)
(b)	$(S_{30}) = \frac{30}{2}(a+l)$ or $\frac{30}{2}(a+40.75)$ or $\frac{30}{2}(2a+(30-1)d)$ or $15(2a+29d)$	M1
	So $1005 = 15[a + 40.75]$ *	A1 cso (2)
(c)	$67 = a + 40.75$ so $\underline{a = (£)\ 26.25 \text{ or } 2625\text{p or } 26\tfrac{1}{4}}$ $\underline{\text{NOT } \tfrac{105}{4}}$	M1 A1
	$29d = 40.75 - 26.25$	M1
	$= 14.5$ so $\underline{d = (£)0.50 \text{ or } 0.5 \text{ or } 50\text{p}}$ or $\frac{1}{2}$	A1 (4)
		8
	Notes	
(a)	M1 for attempt to use $a + (n - 1)d$ with n =30 to form an equation . So $a + (30 – 1)d$ = any number is OK A1 as written. Must see $29d$ not just $(30 - 1)d$. Ignore any floating £ signs e.g. $a + 29d = £40.75$ is OK for M1A1 These two marks must be scored in (a). Some may omit (a) but get correct equation in (c) [or (b)] but we do not give the marks retrospectively. **Parts (b) and (c) may run together**	
(b)	M1 for an attempt to use an S_n formula with n =30 . **Must see one of the printed forms.** ($S_{30} =$ is not required) A1cso for forming an equation with 1005 and S_n and simplifying to printed answer. Condone £ signs e.g. 15[a+ £40.75]=1005 is OK for A1	
(c)	1st M1 for an attempt to simplify the given linear equation for a. Correct processes. Must get to $ka = \dots$ or $k = a + m$ i.e. one step (division or subtraction) from $a = \dots$ Commonly: $15a = 1005 - 611.25$ (= 393.75) 1st A1 For a = 26.25 or 2625p or $26\frac{1}{4}$ NOT $\frac{105}{4}$ or any other fraction 2nd M1 for correct attempt at a linear equation for d, follow through their a or equation in (a) Equation just has to be linear in d, they don't have to simplify to d =… 2nd A1 depends upon 2nd M1 and use of correct a. Do not penalise a second time if there were minor arithmetic errors in finding a provided a = 26.25 (o.e.) is used. Do not accept other fractions other than $\frac{1}{2}$ **If answer is in pence a "p" must be seen.**	
Sim Equ	Use this scheme: 1st M1A1 for a and 2nd M1A1 for d. Typically solving: $1005=30a + 435d$ and $40.75 = a + 29d$. If they find d first then follow through use of their d when finding a.	

Question Number	Scheme	Marks
10. (a)	 (i) ∩ shape (anywhere on diagram)	B1
	Passing through or stopping at (0, 0) and (4,0) only(Needn't be ∩ shape)	B1
	(ii) correct shape (-ve cubic) with a max and min drawn anywhere	B1
	Minimum or maximum at (0,0)	B1
	Passes through or stops at (7,0) but NOT touching. (7, 0) should be to right of (4,0) or B0	B1 (5)
	Condone (0,4) or (0, 7) marked correctly on *x*-axis. Don't penalise poor overlap near origin. **Points must be marked on the sketch...not in the text**	
(b)	$x(4-x)=x^2(7-x)$ $(0=)x[7x-x^2-(4-x)]$	M1
	$(0=)x[7x-x^2-(4-x)]$ (o.e.)	B1ft
	$0=x(x^2-8x+4)$ *	A1 cso (3)
(c)	$\left(0=x^2-8x+4\Rightarrow\right)x=\frac{8\pm\sqrt{64-16}}{2}$ or $(x\pm4)^2-4^2+4(=0)$	M1
	$(x-4)^2=12$	A1
	$=\frac{8\pm4\sqrt{3}}{2}$ or $(x-4)=\pm2\sqrt{3}$	B1
	$x=4\pm2\sqrt{3}$	A1
	From sketch *A* is $x=4-2\sqrt{3}$	M1
	So $y=\left(4-2\sqrt{3}\right)\left(4-[4-2\sqrt{3}]\right)$ (dependent on 1st M1)	M1
	$=-12+8\sqrt{3}$	A1 (7)
		15
	Notes	
(b)	M1 for forming a suitable equation B1 for a common factor of *x* taken out legitimately. Can treat this as an M mark. Can ft their cubic = 0 found from an attempt at solving their equations e.g. $x^3-8x^2-4x=x(...$ A1cso no incorrect working seen. The "= 0" is required but condone missing from some lines of working. Cancelling the *x* scores B0A0.	
(c)	1st M1 for some use of the correct formula or attempt to complete the square 1st A1 for a fully correct expression: condone + instead of ± **or** for $(x-4)^2=12$ B1 for simplifying $\sqrt{48}=4\sqrt{3}$ or $\sqrt{12}=2\sqrt{3}$ .Can be scored independently of this expression 2nd A1 for correct solution of the form $p+q\sqrt{3}$: can be ± or + or − 2nd M1 for selecting their answer in the interval (0,4). If they have no value in (0,4) score M0 3rd M1 for attempting $y=$…using their *x* in correct equation. An expression needed for M1A0 3rd A1 for correct answer. If 2 answers are given A0.	

Question Number	Scheme	Marks
11. **(a)**	$(y=)\dfrac{3x^2}{2}-\dfrac{5x^{\frac{1}{2}}}{\frac{1}{2}}-2x\ \ (+c)$	M1A1A1
	$f(4)=5\ \ \Rightarrow 5=\frac{3}{2}\times 16-10\times 2-8+c$	M1
	$\underline{c=9}$	A1 (5)
	$\left[f(x)=\frac{3}{2}x^2-10x^{\frac{1}{2}}-2x+9\right]$	
(b)	$m=3\times 4-\dfrac{5}{2}-2\ \ \left(=7.5 \text{ or } \dfrac{15}{2}\right)$	M1
	Equation is: $y-5=\dfrac{15}{2}(x-4)$	M1A1
	$\underline{2y-15x+50=0}$ o.e.	A1 (4) **(9marks)**
(a)	1st M1 for an attempt to integrate $x^n \to x^{n+1}$ 1st A1 for at least 2 correct terms in *x* (unsimplified) 2nd A1 for all 3 terms in *x* correct (condone missing +*c* at this point). Needn't be simplified 2nd M1 for using the point (4, 5) to form a linear equation for *c*. Must use *x* = 4 and *y* = 5 and have no *x* term and the function must have "changed". 3rd A1 for *c* = 9. The final expression is not required.	
(b)	1st M1 for an attempt to evaluate $f'(4)$. Some correct use of *x* = 4 in $f'(x)$ but condone slips. They must therefore have at least 3×4 or $-\frac{5}{2}$ and clearly be using $f'(x)$ with *x* = 4. Award this mark wherever it is seen. 2nd M1 for using their value of *m* [or their $-\dfrac{1}{m}$] (provided it clearly comes from using *x* = 4 in f'(*x*)) to form an equation of the line through (4,5)). Allow this mark for an attempt at a normal or tangent. Their *m* must be numerical. Use of *y* = *mx* +*c* scores this mark when *c* is found. 1st A1 for any correct expression for the equation of the line 2nd A1 for any correct equation with integer coefficients. An "=" is required. e.g. 2*y* = 15*x* − 50 etc as long as the equation is correct and has integer coefficients.	
Normal	Attempt at normal can score both M marks in (b) but A0A0	

Further copies of this publication are available from
Edexcel Publications, Adamsway, Mansfield, Notts, NG18 4FN

Telephone 01623 467467
Fax 01623 450481

Email publications@linneydirect.com

Order Code UA023696 Summer 2010

For more information on Edexcel qualifications, please visit www.edexcel.com/quals

Edexcel Limited. Registered in England and Wales no.4496750
Registered Office: One90 High Holborn, London, WC1V 7BH