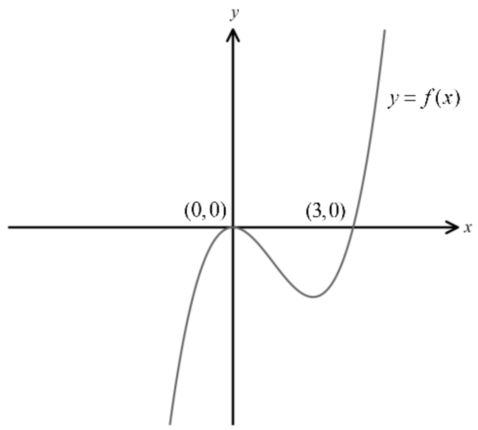
mark scheme

Practice Paper A : Core Mathematics 1

Question Number	General Scheme		Marks
1	$\int(12x^{\frac{3}{4}}-6x+6x^{-2}-2)=\frac{12x^{\frac{7}{4}}}{\frac{7}{4}}-\frac{6x^2}{2}+\frac{6x^{-1}}{-1}-2x,(+c)$	**M1:** correct attempt to integrate one term **A1:** one term correctly integrated **A1:** all terms correctly integrated, $+c$ **not** required	M1 A1 A1
	$\int(12x^{\frac{3}{4}}-6x+6x^{-2}-2)=\frac{36x^{\frac{7}{4}}}{7}-3x^2-6x^{-1}-2x+c$	**A1:** all terms integrated and simplified including the constant of integration Accept $\frac{6}{x}$ for $6x^{-1}$	A1
		Total	4

2	$\frac{4+2\sqrt{7}}{5-2\sqrt{7}}\times\frac{5+2\sqrt{7}}{5+2\sqrt{7}}$	**M1:** multiplies top and bottom by $5+2\sqrt{7}$	M1
	$\frac{\dots}{25-4(7)}=\frac{\dots}{-3}$	**A1:** obtains a denominator of -3	A1
	$\frac{20+8\sqrt{7}+10\sqrt{7}+28}{-3}=\frac{48+18\sqrt{7}}{-3}$	**M1:** correct expansion of the numerator **A1:** correct numerator	M1 A1
	$-16-6\sqrt{7}$	**A1:** cao	A1
		Total	5

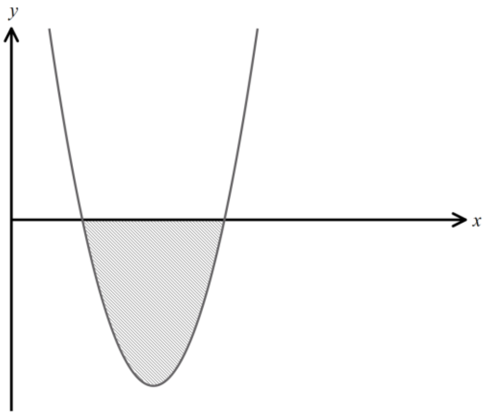
3 (a)		**B1:** correct shape (**positive** cubic showing a repeated root) **B1:** (0,0) labelled **B1:** (3,0) labelled. Accept 3 if clearly on the x axis **Award B0 B1 B1** for correct cubic with repeated root at (3,0) and not (0,0)	B1 B1 B1 (3)
(b)	$(y=x^3-3x^2)$ $\frac{dy}{dx}=3x^2-6x$	**M1:** correct method used to differentiate **A1:** correct differential **oe**	M1 A1

	$3(-1)^2-6(-1)$ $=9$	**M1:** substitutes -1 into *their* gradient function **A1:** 9 **cao**	**M1** **A1** **(4)**
(c)	$[y=(-1)^2(-1-3)]$ $y=-4$	**B1:** $y=-4$	**B1**
	$y-(-4)=9(x-(-1))$ $9x-y+5=0$ **or** $-9x+y-5=0$	**M1:** works out the equation of the tangent using *their* value for y and part (b) **A1:** $a=9, b=-1, c=5$ **or** $a=-9, b=1, c=-5$	**M1** **A1** **(3)**
	Total		**10**

4	**Method 1**		
	$(3^x-81)(3^x-9)=0$	**M1:** factorising in the form $(3^x-a)(3^x-b)(=0)$ **A1:** correct factorising **Note:** accept use of completing the square or the quadratic formula	**M1 A1**
	$3^x-81=0$ or $3^x-9=0$	**M1:** sets both of *their* factors equal to 0	**M1**
	$x=4$ or $x=2$	**A1:** $x=4$ **cao** **A1:** $x=2$ **cao**	**A1 A1**
	Method 2		
	$y=3^x$ $(y-81)(y-9)=0$	**M1:** attempts to use the **correct** substitution **A1:** correct factorising **Note:** accept use of completing the square or the quadratic formula	**M1 A1**
	Then the rest is as method 1.		
	Total		**5**

5 (a)	$a_3 = 10a_2 - a_1 + x$, $a_4 = 10a_3 - a_2 + x$ $a_3 = 58 + x$, $a_4 = 520 + 11x$	**M1:** correct expression to work out a_3 or a_4 **A1:** a_3 or a_4 correct	**M1** **A1**
	$\sum_{r=1}^{4} a_r = 2 + 6 + 58 + x + 520 + 11x$	**M1:** correct expression using *their* values for a_3 and a_4	**M1**
	$\sum_{r=1}^{4} a_r = 586 + 12x$	**A1: cao**	**A1** **(4)**
(b)	$their(a) = 676$ $(586 + 12x = 676)$ $(12x = 90)$	**M1:** sets *their* part (a) equal to 676	**M1**
	$x = \dfrac{90}{12}$	**A1: cao**, **oe**. No ft	**A1** **(2)**
		Total	**6**

6 (i)	$-\frac{2}{3}x^2+2x$	**B1:** correct expression	**B1**
	$\frac{d}{dx}(-\frac{2}{3}x^2+2x)=-\frac{2}{3}(2)x+2$	**M1:** correct method used to differentiate **A1ft:** correct differentiation using *their* expression	**M1** **A1**
	$-\frac{4}{3}x+2$	**A1:** cao	**A1** **(4)**
(ii)	$\frac{x(x-10)(x+10)}{x^2(x-10)}$ $x^{-1}(x+10)$	**M1:** attempts to factorise the numerator **including** an attempt to use the difference of two squares **A1:** correctly factorised expression **A1**: correct simplification	**M1** **A1** **A1**
	$\frac{d}{dx}(1+10x^{-1})$ $=10(-1)x^{-2}$ $=-\frac{10}{x^2}$	**M1:** correct method used to differentiate **A1:** correct differentiation **oe**	**M1** **A1** **(5)**
		Total	**10**
ALT	(i) **Use of the product rule:** $\frac{2}{3}\times\frac{d}{dx}[(-x)(x-3)]=\frac{2}{3}[(-1)(x-3)+(-x)(1)]$ **M1 M1 A1** $=\frac{2}{3}(-x+3-x)$ $=-\frac{4}{3}x+2$ **A1** **B1** becomes **M1** **No ft on 1st A1** **M1** – states or implies use of $vu'+uv'$ **M1** – one term correctly differentiated **A1** – correct expression **A1** – correct answer **cao oe** (ii) **Use of the quotient rule:** **First three marks as in original scheme, then** $\frac{d}{dx}(\frac{x+10}{x})=\frac{x(1)-(x+10)(1)}{x^2}$ **M1 – use of** $\frac{vu'-uv'}{v^2}$ **A1** – answer as in original scheme, **cao**		

7	$(d-50)(d-150)(<0)$ Critical values: $d=50, d=150$	**M1:** Attempts to solve 3TQ **A1:** correct CVs	**M1** **A1**
	 Choosing 'inside' region $50<d<150$	**M1:** graph drawn with 'inside' region chosen. Can be implied by shading **A1: cao**	**M1** **A1**
	$2d-400>d-325$ $d>75$	**M1:** attempts to solve linear equation by making d the subject **A1: cao**	**M1** **A1**
	$75<d<150$ $d_1=75, d_2=150$	**A1 ft:** correct region chosen using *their* values for d	**A1**
		Total	**7**

8	$A(8,0)$, $B(0,-16)$ Midpoint $(4,-8)$	**B1:** both coordinates correct **A1ft:** correct midpoint using *their* A and B	**B1** **A1**
	$m_{l_2} = -\frac{1}{2}$	**B1:** correct gradient **oe**	**B1**
	$y-(-8) = -\frac{1}{2}(x-4)$ ($2y+16=-x+4$) $C(-12,0)$	**M1:** use of $y-y_1=m(x-x_1)$ **A1:** correct coordinate for C	**M1** **A1**
	$BC=\sqrt{12^2+16^2}$ $BC=20$ (sq. units)	**M1:** correct method to work out distance between two points. **A1ft:** correct value of BC.	**M1** **A1**
		Total	**8**

9	$3(x+2y-4)=5x(2x+5)$ $3x+6y-12=10x^2+25x$ $y=\frac{10x^2+22x+12}{6}=\frac{5}{3}x^2+\frac{11}{3}x+2$	**M1:** attempts to make y the subject **A2:** correct rearranging **(Note: A1 for one mistake in rearranging, A0 for more than one)**	**M1** **A2**
	$b^2-4ac=(\frac{11}{3})^2-4(\frac{5}{3})(2)$ $=\frac{121}{9}-\frac{40}{3}=\frac{1}{9}$	**M1:** use of the discriminant. **A1:** $\frac{1}{9}$ cao	**M1** **A1**
	Since <u>$b^2-4ac>0$</u>, the curve has two real solutions.	**A1**: statement seen, including underlined section	**A1**
		Total	**6**
ALT	Candidates may use completing the square (or try to <u>find</u> the roots) instead of using the discriminant. In this case, award **M1** for completing the square (or for the use of another correct method), **A1** for correct expression, **A1** for the roots <u>worked out</u> **or** an explanation.		

10	$y=\int(3x^2+10x-5)dx$ $y=\frac{3x^3}{3}+\frac{10x^2}{2}-5x+b$	**M1:** correct method to integrate **A1:** correct integration. Terms need not be simplified **B1:** constant. Accept any letter	**M1** **A1** **B1**
	$y=x^3+5x^2-5x+b$ $a=5$	**A1ft:** $a=$ the coefficient of *their* x^2 term	**A1**
	$-2=5^3+5(5)^2-5(5)+b$ $-2=125+125-25+b$	**M1:** substitutes coordinates into *their* y **M1:** attempts to solve for *their* 'b'	**M1** **M1**
	$b=-227$	**A1:** cao	**A1**

11	In the n^{th} week, Alice saves <u>£3.75</u>	**M1:** correct method to work out 2.5% **A1:** £3.75	**M1** **A1**
	$3.75=1.05+(n-1)(0.1)$ $27=n-1$ $n=28$	**M1:** use of $a+(n-1)d$ to work out n **A1:** n^{th} term = 28	**M1** **A1**
	$S_{28}=\frac{28}{2}[2(1.05)+(28-1)(0.1)]$ $=\frac{28}{2}(2.10+2.70)$ $=\frac{28}{2}(4.80)$ $=£67.20$	**M1:** use of $S_n=\frac{n}{2}[2a+(n-1)d]$ **A1ft**: correct values substituted **M1:** correct rearranging **A1:** cao	**M1** **A1** **M1** **A1**
		Total	**8**