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January 2005
6663 Core Mathematics C1
Mark Scheme

Question number	Scheme	Marks
1.	(a) 4	B1
	(b) $16^{-\frac{3}{2}} = \frac{1}{16^{\frac{3}{2}}}$ and attempt to find $16^{\frac{3}{2}}$	M1
	$\frac{1}{64}$ (or exact equivalent, e.g. 0.015625)	A1 (3)
		3
	(b) <u>Any</u> attempt to evaluate $16^{\frac{3}{2}}$. Answer only scores both marks.	

Question number	Scheme		Marks	
2.	(i) (a) $15x^2 + 7$		M1 A1 A1	(3)
	(i) (b) $30x$		B1ft	(1)
	(ii) $x + 2x^{\frac{3}{2}} + x^{-1} + C$	A1: $x + C$, A1: $2x^{\frac{3}{2}}$, A1: x^{-1}	M1 A1 A1 A1	(4)
				8
	(i) (a) A1: 2 terms correctly differentiated. A1: Fully correct. (ii) Allow any equivalent version of each term.			

Question number	Scheme	Marks
3.	Attempt to use discriminant $b^2 - 4ac$ (Need not be equated to zero)	M1
	$144 - 4 \times k \times k = 0$	A1
	Attempt to solve for k	M1
	$k = 6$	A1 (4)
		4

Alternative for first 2 marks

Attempt to complete square $(x \pm p)^2 \pm q \pm c$, $p \neq 0$, $q \neq 0$ — M1

$1 - \dfrac{36}{k^2} = 0$ or equiv. — A1

Other alternatives

(i) $x^2 + \dfrac{12}{k}x + 1$ must be equivalent to $(x+1)^2$ — M1 A1

Compare coefficients and attempt to solve for k: $\dfrac{12}{k} = 2$ $k = 6$ — M1 A1

(ii) Finding the root first, e.g. $(\sqrt{k}x + \sqrt{k})^2 = 0$, so $x = -1$ — M1 A1

Substitute the root to find k, $k = 6$ — M1 A1

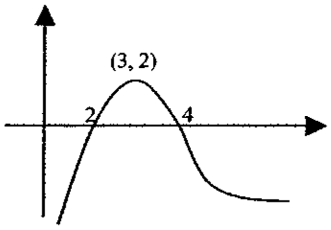
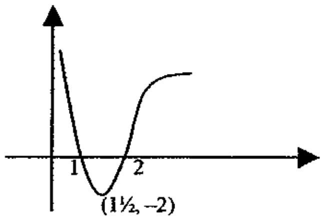
Answer only

Scores 2 marks: M0 A0 M1 A1

The first two marks would only be scored if solution then justifies that $k = 6$ gives equal roots.

Question number	Scheme	Marks
4.	$x^2+2(2-x)=12$ or $(2-y)^2+2y=12$ (Eqn. in x or y only)	M1
	$x^2-2x-8=0$ or $y^2-2y-8=0$ (Correct 3 term version)	A1
	$(x-4)(x+2)=0$ $x=\dots$ or $(y-4)(y+2)=0$ $y=\dots$	M1
	$x=4$, $x=-2$ or $y=4$, $y=-2$	A1
	$y=-2$, $y=4$ or $x=-2$, $x=4$ (M: attempt one, A: both)	M1 A1ft (6) **6**
	A1ft requires 3 s.f. accuracy if not exact. <u>"Non-algebraic" solutions:</u> No working, and only one correct solution pair found (e.g. $x=4$, $y=-2$): M0 A0 M0 A0 M1 A1 No working, and both correct solution pairs found, but not demonstrated: M0 A0 M1 A1 M1 A1 Both correct solution pairs found, and demonstrated, perhaps in a table of values: Full marks	

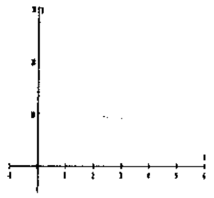
Question number	Scheme			Marks	
5.	(a)	$-3,\ -1,\ 1$	B1: One correct	B1 B1	(2)
	(b)	2	(ft only if terms in (a) are in arithmetic progression)	B1ft	(1)
	(c)	Sum $= \frac{1}{2}n\{2(-3)+(n-1)(2)\}$ or $\frac{1}{2}n\{(-3)+(2n-5)\}$		M1 A1ft	
		$= \frac{1}{2}n\{2n-8\} = n(n-4)$	(*)	A1	(3)
					6

Question number	Scheme		Marks	
6.	(a) 	Reflection in x-axis	B1	
		2 and 4 labelled (or (2, 0) and (4, 0) seen)	B1	
		Image of P (3, 2)	B1	(3)
	(b) 	Stretch parallel to x-axis	M1	
		1 and 2 labelled (or (1, 0) and (2, 0) seen)	A1	
		Image of P (1½, −2)	A1	(3)
				6

Question number	Scheme	Marks
7.	(a) $\frac{5-x}{x} = \frac{5}{x} - 1 \quad \left(= 5x^{-1} - 1\right)$	M1
	$\frac{dy}{dx} = 8x - 5x^{-2}$	M1 A1 A1
	When $x = 1$, $\frac{dy}{dx} = 3$ (*)	A1 (5)
	(b) At P, $y = 8$	B1
	Equation of tangent: $y - 8 = 3(x-1)$ $(y = 3x + 5)$ (or equiv.)	M1 A1ft (3)
	(c) Where $y = 0$, $x = -\frac{5}{3}$ $(= k)$ (or exact equiv.)	M1 A1 (2)
		10
	(a) First M1 can also be scored by an attempt to use the quotient or product rule to differentiate $\frac{5-x}{x}$. (b) The B mark may be earned in part (a).	

Question number	Scheme	Marks	
8.	(a) $p = 15,\ \ q = -3$	B1 B1	(2)
	(b) Grad. of line ADC: $m = -\frac{5}{7}$, Grad. of perp. line $= -\frac{1}{m}$ $\left(= \frac{7}{5}\right)$	B1, M1	
	Equation of l: $y - 2 = \frac{7}{5}(x - 8)$	M1 A1ft	
	$7x - 5y - 46 = 0$ (Allow rearrangements, e.g. $5y = 7x - 46$)	A1	(5)
	(c) Substitute $y = 7$ into equation of l and find $x = \ldots$	M1	
	$\frac{81}{7}$ or $11\frac{4}{7}$ (or exact equiv.)	A1	(2)
			9
	(a) <u>Special case:</u> If B0 B0 from main scheme, allow M1 for a correct method, e.g. $8 = \frac{1+p}{2}$. (b) Finding eqn. of ADC instead of l scores M1 A0 A0.		

Question number	Scheme	Marks	
9.	(a) Gradient of tangent at P: $m = 4$, Grad. of normal $= -\frac{1}{m}$ $\left(= -\frac{1}{4}\right)$	B1, M1	
	Equation of normal: $y - 4 = -\frac{1}{4}(x - 1)$ $(4y = -x + 17)$	M1 A1	(4)
	(b) $(3x-1)^2 = 9x^2 - 6x + 1$	B1	
	Integrate: $\frac{9x^3}{3} - \frac{6x^2}{2} + x$ $(+C)$	M1 A1ft	
	Substitute (1, 4) to find $c = \ldots$, $c = 3$ $(y = 3x^3 - 3x^2 + x + 3)$	M1, A1	(5)
	(c) Gradient of (tangent to) C is ≥ 0	B1	
	Gradient of given line is < 0 (-2)	B1	(2)
			11
	(a) Using gradient of tangent is M0. (b) <u>Alternative:</u> $y = \frac{(3x-1)^3}{9}$ $(+C)$ M1 A1 (numerator) A1 (denominator) Substitute (1, 4) to find $c = \ldots$, $c = \frac{28}{9}$ $\left(y = \frac{(3x-1)^3}{9} + \frac{28}{9}\right)$ M1, A1		

Question number	Scheme	Marks
10.	(a) $x^2 - 6x + 18 = (x-3)^2,\ +9$	B1, M1 A1 (3)
	(b)  "U"-shaped parabola	M1
	Vertex in correct quadrant	A1ft
	P: (0, 18) (or 18 on *y*-axis)	B1
	Q: (3, 9)	B1ft (4)
	(c) $x^2 - 6x + 18 = 41$ or $(x-3)^2 + 9 = 41$	M1
	Attempt to solve 3 term quadratic $x = \ldots$	M1
	$x = \dfrac{6 \pm \sqrt{36 - (4 \times -23)}}{2}$ (or equiv.)	A1
	$\sqrt{128} = \sqrt{64} \times \sqrt{2}$ (or equiv. surd manipulation)	M1
	$3 + 4\sqrt{2}$ (Ignore other value)	A1 (5)
		12
	(a) M1 requires $(x \pm a)^2 \pm b \pm 18,\ a \neq 0,\ b \neq 0$ Answer only: full marks.	