6671 Pure Mathematics P1

Mark Scheme

Question Number	Scheme	Marks
1.	Forming equation in x or y by attempt to eliminate one variable	
	$(3-y)^2 + y = 15$ *or* $x^2 + (3-x) = 15$	M1
	$y^2 - 5y - 6 = 0$ *or* $x^2 - x - 12 = 0$ (Correct 3 term version)	A1
	Attempt at solution i.e. solving 3 term quadratic: $(y-6)(y+1) = 0$, $y = \ldots$ or $(x-4)(x+3) = 0$, $x = \ldots$ or correct use of formula or correct use of completing the square	M1
	$x = 4$ and $x = -3$ **or** $y = -1$ and $y = 6$	A1
	Finding the values of the other coordinates (M attempt one, A both)	M1 A1 ft (6)
2.	Using $\sin^2\theta + \cos^2\theta = 1$ to give a quadratic in $\cos\theta$.	M1
	Attempt to solve $\cos^2\theta + \cos\theta = 0$	M1
	($\cos\theta = 0$) $\Rightarrow \theta = \frac{\pi}{2}, \frac{3\pi}{2}$	B1, B1
	($\cos\theta = -1$) $\Rightarrow \theta = \pi$	B1
	(Candidate who writes down 3 answers only with no working scores a maximum of 3)	(5)
3. (a)	Attempt f (2) ; = 16 – 4 + 4 - 16 = 0 $\Rightarrow$ (x – 2) is a factor must be statement for A1	M1; A1 (2)
(b)	$c = 8$	B1
	A complete method to find b Either compare coefficients of x or x^2 : $-2b + 8 = 2$, or $-4 + b = -1$ Or substitute value of x (may be implied) : e.g.($x = 1$) $\Rightarrow$ $-13 = (-1)(10 + b)$	M1
	$b = 3$	A1 (3)
(c)	Checking $b^2 - 8c$; -55 $\Rightarrow$ no real roots to the quadratic	M1; A1
	$\Rightarrow$ $x = 2$ is the only solution	A1 (3)

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4 (a)	Correct strategy for differentiation e.g. $y = 4x^2 + (5x-1)x^{-1}$ multiplied out with correct differentiation method, or product or quotient rules applied correctly to $\frac{5x-1}{x}$.	M1
	$\frac{dy}{dx} = 8x, \quad +\frac{1}{x^2}$ B1 for $8x$ seen anywhere.	B1, A1 (3)
(b)	Putting $\frac{dy}{dx} = 0$	M1
	So $8x^3 + 1 = 0 \quad \Rightarrow x = -\frac{1}{2}$. M1 requires multiplication by denominator and use of a root in the solution	M1 A1 (3)
(c)	Complete method: Either $\frac{d^2y}{dx^2} = 8 - \frac{2}{x^3}$, with x value substituted, or gradient either side checked	M1
	Completely correct argument, either > 0 with no error seen,(24)or –ve to +ve gradient, then **minimum** stated	A1 (2)
5(a)	p = 15, q = -3	B1, B1
	Special case if B0 B0, allow M1 for method, e.g. $8 = \frac{1+p}{2}$	(2)
(b)	Gradient of line ADC = $-\frac{5}{7}$, gradient of perpendicular line = $-\frac{1}{\text{gradient } ADC}$ $\left(\frac{7}{5}\right)$	B1, M1
	Equation of l: $y - 2 = (\frac{7}{5})(x-8)$ $\Rightarrow 7x - 5y - 46 = 0$ (Allow rearrangements of this)	M1 A1ft A1cao (5)
(c)	Substituting y = 7 and finding value for x,	M1
	$x = \frac{81}{7}$ or $11\frac{4}{7}$	A1 (2)

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6 (a)	$P = r\theta + 2r,$ $\quad A = \frac{1}{2}r^2\theta$	B1, B1 (2)
(b)	Substituting value for r and equating P to A. $[2\sqrt{2}(2+\theta) = \frac{1}{2}(2\sqrt{2})^2\theta]$	M1
	Correct process to find θ $[\theta(\sqrt{2}-1) = 2]$	M1
	$\theta = \dfrac{2}{\sqrt{2}-1}$ * often see $\theta = \dfrac{4\sqrt{2}}{4-2\sqrt{2}}$	A1 c.s.o. (3)
(c)	Multiply numerator and denominator by ($\sqrt{2}+1$)	M1
	$2, +2\sqrt{2}$	A1, A1 (3)
7 (a)	Applying correct formula [325 = 120 +5(n-1)]	M1
	Solving to give n =42 * (or verifying in correct equation)	A1 (2)
(b)	Using formula for sum of AP: S = $\frac{42}{2}\{240+5(42-1)\}$ or use $\frac{n}{2}\{a+l\}$	M1 A1
	= 9345	A1 (3)
(c)	Recognising GP with r = 0.98	M1
	Value (in £) = 7200 (0.98) ^{24}	M1
	= 4434 (only this value)	A1 (3)

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8 (a)	Substitute x =0, $y = \sqrt{3}$ to give $\sqrt{3} = k\dfrac{\sqrt{3}}{2} \Rightarrow k = 2$ (or verify result) must see $\dfrac{\sqrt{3}}{2}$	B1 (1)
(b)	p = 120, q = 300 (f.t. on p +180)	B1, B1ft (2)
(c)	$arc\sin(-0.8) = -53.1$ or $arc\sin(0.8) = 53.1$	B1
	(x + 60) = 180 – arcsin(-0.8) or equivalent 180 + arcsin 0.8	M1
	First value of x = 233.1 – 60, i.e. x = 173.1	A1
	OR (x + 60) =360 + arcsin(-0.8) or equivalent 360 –arcsin 0.8, i.e. x = 246.9	M1, A1 (5)
9 (a)	$(x-3)^2, +9$ isw . a = 3 and b = 9 may just be written down with no method shown.	B1, M1 A1 (3)
(b)	P is (3, 9)	B1 ft, B1ft (2)
(c)	A = (0, 18)	B1
	$\dfrac{dy}{dx} = 2x - 6$, at A m = -6	M1 A1
	Equation of tangent is y – 18 = -6x (in any form)	A1ft (4)
(d)	Showing that line meets x axis directly below P , i.e. at x = 3.	A1cso (1)
(e)	$A = \int x^2 - 6x + 18\,dx = [\frac{1}{3}x^3 - 3x^2 + 18x]$	M1 A1
	Substituting x =3 to find area A under curve A [=36]	M1
	Area of R = A – area of triangle= $A - \frac{1}{2}\times 18\times 3$, = 9	M1 A1 (5)
	Alternative: $\int x^2 - 6x + 18 - (18 - 6x)\,dx$ M1	
	= $\frac{1}{3}x^3$ M1 A1 ft	
	Use x = 3 to give answer 9 M1 A1	