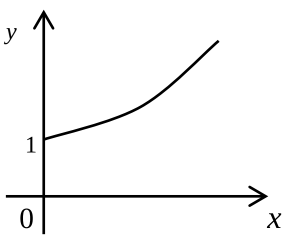
Question number	Scheme	Marks
1. (*a*)	f(–3) = –27 – 27 + 30 + 24 = 0 ⇒ (x + 3) is factor	M1 A1 (2)
(*b*)	$(x + 3)(x^2 - 6x + 8)$	M1 A1
	$(x + 3)(x - 2)(x - 4)$	M1 A1 (4)
		(6 marks)
2. (a)	Using $\mathrm{f}(\pm 2) = 3$	M1
(b)	Showing that p = 6 (*), with no wrong working seen.	
	S.C. If p = 6 used and the remainder is shown to be 3 award B1	A1 (2)
	Attempt to find quotient when dividing (n + 2) into f(n) or attempting to equate coefficients.	M1
	Quotient = $n^2 + 4n + 3$, or finding either q = 1 or r = 3	A1
	Finding both q = 1 and r = 3	A1 (3)
	The product of three consecutive numbers must be divisible by 3	M1
	Complete argument	A1 (2)
		(7 marks)
3.	$2\sin^2\theta - 2\sin\theta = 1 - \sin\theta$	M1
	$3\sin^2\theta\, 2\sin\theta - 1 = 0$	A1
	$(3\sin\theta + 1)(\sin\theta - 1) = 0$ (or attempt by formula)	M1 A1 ft
	$\sin\theta = \frac{1}{3}$ $\sin\theta = 1$	A1
	θ = –19.5° –160.5° 90°	A1 A1ft A1 (8)
		(8 marks)
4. (a)	 shape	B1
	domain, intercept	B1 (2)
(b)	$£800 \times 1.04^{10} \approx £1184$ cao	M1 A1 (2)
(c)	$1.04^x = 2$	M1
	$x = \frac{\ln 2}{\ln 1.04} \approx 18$ (years)	M1 A1 (3)
		(7 marks)

Question number	Scheme	Marks
5. (a)	(0, 2) on $C \Rightarrow 2 = p + q$ — Use of (0, 2) equation in p and q	M1
	$\frac{dy}{dx} = qe^x$, at $p \Rightarrow 5 = 2q$	M1, A1
	Solving $\Rightarrow$ $q = 2.5$, $p = -0.5$ (or $2 - q$)	A1, A1 **(5)**
(b)	Gradient of normal at P is $-\frac{1}{5}$	B1
	Equation of normal at P is: $y - (p + 2q) = -\frac{1}{5}(x - \ln 2)$	M1
	at L $y = 0$ $\therefore x_L = 22.5 + \ln 2$ or $5(p + 2q) + \ln 2$ or 23.19….	M1
	at M $x = 0$ $\therefore y_M = 4.5 + \frac{1}{5}\ln 2$ or $p + 2q + \frac{1}{5}\ln 2$ or 4.639….	
	Area of triangle OLM is : $\frac{1}{2} x_L \times y_M = 53.792…. \approx 53.8$	M1, A1 cso **(5)**
		(10 marks)
6. (a)	Solve $\frac{3}{2}x^2 - \frac{1}{4}x^3 = 0$ to find $p = 6$, or verify: $\frac{3}{2}\times 6^2 - \frac{1}{4}\times 6^3 = 0$ (*)	B1 (1)
(b)	$\frac{dy}{dx} = 3x - \frac{3x^2}{4}$	M1 A1
	$m = -9$, $y - 0 = -9(x - 6)$ (Any correct form)	M1 A1 (4)
(c)	$3x - \frac{3x^2}{4} = 0$, $x = 4$	M1, A1ft (2)
(d)	$\int \left(\frac{3x^2}{2} - \frac{x^3}{4}\right) dx = \frac{x^3}{2} - \frac{x^4}{16}$ (Allow unsimplified versions)	M1 A1
	$[\ldots\ldots\ldots]_0^6 = \frac{6^3}{2} - \frac{6^4}{16} = 27$ M: Need 6 and 0 as limits.	M1 A1 (4)
		(11 marks)

Question number		Scheme	Marks
7.	(a)	Area of $X = 2d^2 + \frac{1}{2}\pi d^2$, Area of $Y = \frac{1}{2}(4d^2)\theta$	B1, M1 A1
		Equate and divide by d^2: $2 + \frac{1}{2}\pi = 2\theta$, $\theta = 1 + \frac{1}{4}\pi$ *	M1 A1 (5)
	(b)	$12 + 3\pi$	B1 B1 (2)
	(c)	$4d + r\theta$, $= 12 + 6(1 + \frac{1}{4}\pi)$, $= 18 + \frac{3}{2}\pi$	M1, A1, A1 (3)
	(d)	X: $12 + 3\pi = 21.425$ cm, Y: $18 + \frac{3}{2}\pi = 22.712$ cm	
		Difference = 13 mm (or 12.9 mm) or 12.88 mm	M1 A1 (2)
			(12 marks)
8.	(a)	$f(x) = \ldots + \binom{n}{2}\frac{x^2}{k^2} + \binom{n}{3}\frac{x^3}{k^3}$	M1
		$2 \times \frac{n(n-1)}{2k^2} = \frac{n(n-1)(n-2)}{6k^3}$	M1
		$6k = n - 2$ or $n = 6k + 2$ *	A1 cso (3)
	(b)	$\frac{n(n-1)(n-2)(n-3)}{4!\ \ k^4} = \frac{n(n-1)(n-2)(n-3)(n-4)}{5!\ \ k^5} \Rightarrow 5k = n - 4$	M1 A1
		Solving: $5k = 6k + 2 - 4$, $\Rightarrow k = 2$ and $n = 14$ *	M1, A1 cso (4)
	(c)	$(1 + \frac{x}{2})^{14} = 1 + 7x + \binom{14}{2}\frac{x^2}{2} + \binom{14}{3}\left(\frac{x^3}{3}\right) + \binom{14}{4}\frac{x^4}{16} + \binom{14}{5}\frac{x^5}{32}\ldots$	M1
		$= 1 + 7x, + \frac{91}{4}x^2 + \frac{91}{2}x^3, + \frac{1001}{16}x^4 + \frac{1001}{16}x^5$	B1, A1, A1 (4)
			(11 marks)