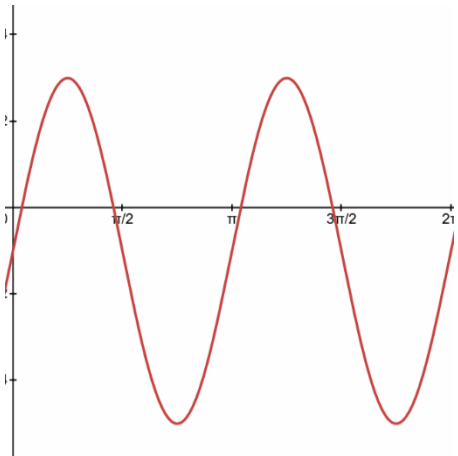


MARK SCHEME

Qn	Solution	Marks
1	$x = 1 + y \quad \text{---(1)}$ $x^2 + y^2 + xy - 7 = 0 \quad \text{---(2)}$ sub (1) into (2) $(1 + y)^2 + y^2 + y(1 + y) - 7 = 0$ $3y^2 + 3y - 6 = 0$ $y^2 + y - 2 = 0$ $y = 1 \text{ or } y = -2$ $x = 2 \text{ or } x = -1$ $x = 2, y = 1 \text{ or } x = -1, y = -2$	M1- substitution M1-simplifying eqn M1 for substituting to find the other variable A1, A1 for each set of x and y values
2(a)	$c = \frac{-4 + 2}{2}$ $= -1$ $a = 3$ $b = \frac{360}{180}$ $= 2$	B1 B1 B1
(b)	 Min point = -5 Max point = 4	B1 – sine graph B1- correct min and max value B1- 2 cycles (to show π and 2π on the x axis minimally)
3(i)	$y = x^2 + px + 2p + 5$ $b^2 - 4ac < 0$ $p^2 - 4(1)(2p + 5) < 0$ $p^2 - 8p - 20 < 0$ $-2 < p < 10$	M1-discriminant M1- correct sub of a, b, c

		M1- simplifying A1
(ii)	By comparing constant $2p + 5 = -1$ $p = -3$ Since $p = -3$ is not within the range of $-2 < p < 10$, his claim is not correct	B1- identifying $p = -3$ and using (i) inequality to explain
4(i)	Since curve has stationary points at $x = 2$ and $x = -2$, $\frac{dy}{dx} = 0$ So when $\frac{dy}{dx} = 0$, $\frac{dy}{dx} = k(x+2)(x-2)$ $= k(x^2 - 4)$	B1- identifying of stationary points B1- forming of equation
(ii)	$\frac{dy}{dx} = k(x^2 - 4)$ $= kx^2 - 4k$ $y = \int kx^2 - 4k \, dx$ $y = \frac{kx^3}{3} - 4kx + c$ sub $x = -1$ and $y = 2$ $2 = \frac{k(-1)^3}{3} - 4k(-1) + c$ $2 = -\frac{1}{3}k + 4k + c$ $2 - \frac{11}{3}k = c \text{ --- (1)}$ sub $x = -2$ and $y = -3$ $-3 = \frac{k(-2)^3}{3} - 4k(-2) + c$ $-3 = -\frac{8}{3}k + 8k + c$ $-3 - \frac{16}{3}k = c \text{ --- (2)}$ (1) = (2) $2 - \frac{11}{3}k = 3 - \frac{16}{3}k$ $6 - 11k = 9 - 16k$ $k = -3$	M1-integrating with c included M1- for eqn 1 M1 for eqn 2 M1 for solving k

		M1 for solving c A1 for eqn
(iii)	$a = 29$	B1
5(i)	$\frac{1}{2}(\sqrt{5}+1)(3\sqrt{5}-2)\sin XTU = 6$ $(15-2\sqrt{5}+3\sqrt{5}-2)\sin XTU = 12$ $\sin XTU = \frac{12}{13+\sqrt{5}}$ $\sin XTU = \frac{12}{13+\sqrt{5}} \left(\frac{13-\sqrt{5}}{13-\sqrt{5}} \right)$ $= \frac{156-12\sqrt{5}}{164}$ $= \frac{39-3\sqrt{5}}{41}$	M1- area of triangle formula M1- expansion of surds M1-simplifying of surds M1-conjugate surds M1 A1
(ii)	52.0 and 128.0	B1
6(i)	$f(3) = 0$ $(3)^3 + p(3)^2 + q(3) - 12 = 0$ $9p + 3q = -15$ $3p + q = -5 \quad \text{---(1)}$ $f(-2) = 10$ $(-2)^3 + p(-2)^2 + q(-2) - 12 = 10$ $4p - 2q = 30$ $2p - q = 15 \quad \text{---(2)}$ $(1) + (2)$ $5p = -5 + 15$ $5p = 10$ $p = 2$	M1-for $f(3) = 0$ M1 M1- for $f(-2) = 10$ M1 A1

sub $p = 2$ into (1) $q = -11$

		A1
(ii)	$f(x) = (x-3)(ax^2 + bx + c)$ by comparing coefficient $x^3 : a = 1$ constant: $-3c = -12$ $c = 4$ $x^2 : b - 3a = 2$ $b - 3(1) = 2$ $b = 5$ $f(x) = (x-3)(x^2 + 5x + 4)$ Let $f(x) = (x-3)(x+4)(x+1)$	M1 for comparing coefficient or long division to find quadratic factor M1 for $x^2 + 5x + 4$ A1
7(i)	$\text{LHS} = \sin x \left(\frac{1}{\sin x} - 1 \right) (1 + \sin x)$ $= (1 - \sin x)(1 + \sin x)$ $= 1 - \sin^2 x$ $= \cos^2 x$ $= \text{RHS}$	$\frac{1}{\sin x}$ M1 for $\frac{1}{\sin x}$ M1 for $1 - \sin^2 x$ A1
(ii)	Let $x = 2x$ and $0 < 2x < 4\pi$ $\cos^2 2x = 1$ $\cos 2x = 1$ or $\cos 2x = -1$ $2x = 0, 2\pi, 4\pi$ or $2x = \pi, 3\pi$ $x = \pi, \frac{\pi}{2}, \frac{3\pi}{2}$	M1 M1 M1 A2 – for all 3 answers [A1 for 2 correct answers]
8(i)	$\sqrt{(2p-0)^2 + (p-0)^2} = \sqrt{245}$ $5p^2 = 245$ $p^2 = 49$ $p = 7$ or $p = -7(\text{rej})$	M1 M1 A1
(ii)	$m_{OA} = \frac{1}{2}$	B1
(iii)	$m_{AB} = -2$ sub $m = -2, x_1 = 14, y_1 = 7$ $y - 7 = -2(x - 14)$ $y = -2x + 35$	M1 A1
(iv)	$B = (0, 35)$ $N = \left(\frac{14+0}{2}, \frac{7+35}{2} \right)$ $N = (7, 21)$	M1

	Let $C = (x, -2x)$	M1 M1-equating the gradient A1
(v)	$\frac{1}{2} \begin{vmatrix} 0 & 14 & 0 & -7 & 0 \\ 0 & 7 & 35 & 14 & 0 \end{vmatrix}$ $= \frac{1}{2} (490 + 245)$ $= 367.5 \text{ units}^2$	M1 A1
9(i)	sub $y = 0$ $x^3 + 3x^2 - 4x = 0$ $x(x^2 + 3x - 4) = 0$ $x(x + 4)(x - 1) = 0$ $E = (-4, 0)$ and $F = (1, 0)$	M1- sub $y=0$ M1 A1, A1
(ii)	$\frac{dy}{dx} = 3x^2 + 6x - 4$	B1
(iii)	$3x^2 + 6x - 4 = -4$ $x(3x + 6) = 0$ $x = 0(\text{rej})$ or $3x + 6 = 0$ $x = -2$	$\frac{dy}{dx} = 0$ M1 - $\frac{dy}{dx} = 0$ M1 A1
(iv)	sub $x = -2$ $y = -4(-2) + 4 = 12$ Area = $\int_{-4}^{-2} x^3 + 3x^2 - 4x \, dx + \frac{1}{2} \times 3 \times 12$ $= \left[\frac{x^4}{4} + \frac{3x^3}{3} - \frac{4x^2}{2} \right]_{-4}^{-2} + 18$ $= 38$	M1 for $\int_{-4}^{-2} x^3 + 3x^2 - 4x \, dx$ M1 for area of triangle M1 for integrating A1

