1. a) $\boxed{512}$ $\boxed{+2304x}$ $+4608x^2$ $\boxed{+5376x^3}$ **B4**

b) $512 + 2304\left(-\frac{1}{4}x\right) + 4608\left(-\frac{1}{4}x\right)^2 + 5376\left(-\frac{1}{4}x\right)^3$ **M1**

$512 \boxed{-576x + 288x^2 - 84x^3}$ **A1**

(IF A BINOMIAL EXPANSION IS ATTEMPTED AGAIN TIMED $-A2$ FOR THE LAST A1 WITH -1 eeoo)

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2. $6a^2 - a + 7$ **B1**

$24a^2 - 2a + 7$ **B1**

$"24a^2 - 2a + 7" = "6a^2 - a + 7"$ AT LEAST ONE SIDE CORRECT **M1**

$18a^2 - 3a = 0$ **M1**

$a = \frac{1}{6}$ **-A1**

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3. $\left(\frac{dy}{dx} = \right) 3x^2 - 6x - 24$ **M1**

$"3x^2 - 6x - 24" > 0$ **B1**

$k(x+2)(x-4)$ o.e   **M1**

4 & -2 seen   **A1**
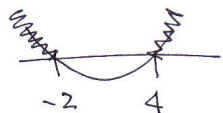
-2 4 OR SIMILAR **M1**

$x < -2$ OR $x > 4$ **A1** dep

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4. a) $x(x^2 - 8x + 4)$ **M1**

$x(x-4)^2$ **M1**

STATES $x = 4$ IS A & O IS ORIGIN, o.e   **A1**

b) $\int_0^4 x^3 - 8x^2 + 16x \, dx$ **M1 M1** (ONE MARK FOR UNITS)

$\frac{1}{4}x^4 - \frac{8}{3}x^3 + 8x^2$ **M1**

$64 - 512 + 128$ **M1**

$64/3$ **A1**

5. a) $\left(\dfrac{dy}{dx}=\right)1-8x^3$ B1

$"1-8x^3"=0$ M1

$x=\dfrac{1}{2}$ A1

$y=\dfrac{3}{8}$ A1

$\left(\dfrac{d^2y}{dx^2}=\right)-24x^2$ M1

$\left.\dfrac{d^2y}{dx^2}\right|_{x=\frac{1}{2}}=-24\left(\dfrac{1}{2}\right)^2=-6<0\Bigg)$ A1

$\therefore$ MAX

b) $\dfrac{d^3y}{dx^3}=-48x$ B1

$\dfrac{d^2y}{dx^2}=0 \implies x=0$ A1

$\implies \dfrac{d^3y}{dx^3}=0$

$\therefore$ NO POINTS OF INFLEXION

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6. a) $\left(6\sqrt{3}\right)^2=6^2+6^2-2\times6\times6\cos"\theta"$ M1

$72\cos"\theta"=-36$ O.E   M1

$\cos"\theta"=-\dfrac{1}{2}$ AND $"\theta"=\dfrac{2\pi}{3}$ A1

ALTERNATIVE

$\sin"\phi"=\dfrac{\sqrt{3}}{2}$ M1

$\phi=\dfrac{\pi}{3}$ M1

$A\hat{O}B=\dfrac{2\pi}{3}$ A1

b) $\tan\dfrac{\pi}{3}=\dfrac{|AP|}{6}$ M1

$|AP|=6\sqrt{3}$ A1

AREA OF TRIANGLE $\dfrac{1}{2}\times6\times6\sqrt{3}$ M1

$18\sqrt{3}$ A1

$2\times18\sqrt{3}=36\sqrt{3}$ A1

c) $\dfrac{1}{2}\times6^2\times\dfrac{2\pi}{3}$ M1

12π A1

A.W.R.T 24.7 A1

7.

$$6\cos\psi = \frac{5\sin\psi}{\cos\psi} \qquad \text{M1}$$

$$6\cos^2\psi = 5\sin\psi \qquad \text{M1}$$

$$6(1-\sin^2\psi) = 5\sin\psi \qquad \text{M1}$$

$$6\sin^2\psi + 5\sin\psi - 6 = 0 \qquad \text{A1}$$

"$(3a-2)(2a+3)$" O.E   M1

$$\sin\psi = \frac{2}{3} \quad \text{&/or} \quad -\frac{3}{2} \qquad \text{A1}$$

$$\psi_1 = 0.73^c \qquad \text{A1}$$
$$\psi_2 = 2.41^c \qquad \text{A1}$$

8.

ATTEMPT TO CREATE A QUADRATIC IN 2^y,

e.g $(2^2)^y$ or 2^{2y} ⎫ M1

"$a^2 - 3a - 10$" OR SIMILAR   M1

$(2^y + 2)(2^y - 5)$ OR $(a+2)(a-5)$ M1

$2^y = 5$ A1   (IGNORE $2^y = -2$)

USES LOGS CORRECTLY   M1

A.W.R.T 2.32   A1   (MUST NOT HAVE ANOTHER ANSWER)

9. a) ATTEMPTS TO COMPLETE THE SQUARE   M1

CENTRE $(5,5)$ A1

RADIUS $= 3$ A1

b) $\boxed{(x-1)^2 + (y-5)^2 = 1}$ B1 B1

$\boxed{(x-4)^2 + (y-5)^2 = 16}$ B1 B1

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10. a) $ar^7 = 10ar^3$ M1

$r^4 = 10$ M1

$r = 10^{\frac{1}{4}}$ & STATE $r = 1.778$ A1

b) $\dfrac{a(r^8 - 1)}{r-1} = \dfrac{10a(r^4 - 1)}{r-1}$ M1

$r^8 - 1 = 10r^4 - 10$ M1

$r^8 - 10r^4 + 9 = 0$ AG   A1

c) $"(r^4 - 9)(r^4 - 1)"$ M1

$r^4 = \begin{cases} 9 \\ 1 \end{cases}$ A1

$r^2 = \begin{cases} 3, -\cancel{3} \\ 1, \cancel{1} \end{cases}$ A1

$r = +\sqrt{3}$ WITH FULL JUSTIFICATION   A1