1. $2x + \dfrac{-x-2}{x^2+1}$ OR $2x - \dfrac{x+2}{x^2+1}$ OR

$A=2$ B1

$B=0$ B1

$C=-1$ B1

$D=-2$ B1

2 (a) $yx+3y=x$ OE M1

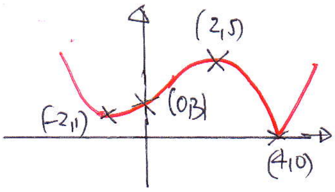
$x = \dfrac{3y}{1-y}$ OE M1

$f^{-1}(x) = \dfrac{3x}{1-x}$ OR $f^{-1}(x) = \dfrac{-3x}{x-1}$ A1 A1 (DEP)

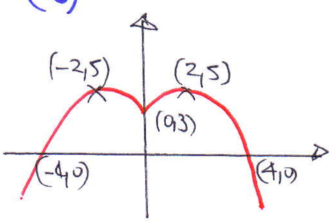
(b) $f(3)$ B1

$\frac{1}{2}$ A1

3. (a)



(b)



B1 SHAPE

B1 4 CORRECT CO-ORDINATES

(ALLOW 1 OMISSION BUT NO ERROR)

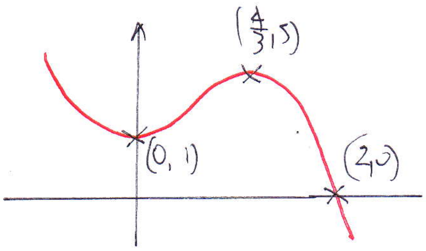
B1 SHAPE

B1 (0,3)

B1 (-2,5) (2,5) (-4,0) (4,0) ALL 4

(ALLOW ONE OMISSION IF SHAPE IS CORRECT)

(c)



B1 SHAPE

A2 (0,1), ($\frac{4}{3}$,5), (2,0) −1 eeoo

4. (a) $R\cos\theta\cos\alpha - R\sin\theta\sin\alpha$ M1

$R\cos\alpha = \sqrt{2}$
OR $R\sin\alpha = \sqrt{6}$ M1

$R = \sqrt{8}$ A1
$\alpha = 60°$ A1

(b) $\sqrt{8}\cos(\theta + 60°) = 2$ OR $\cos(\theta+60) = \frac{\sqrt{2}}{2}$ OE B1

$45°$ (SEEN OR IMPLIED) A1

$\theta + 60 = 45$ M1

$\theta + 60 = 315$ M1

$\theta = 255, 345$ (BOTH) A1

(c) (I) 0 B1
(II) $\frac{1}{8}$ B1

(a) $12000 = Ae^0$ OR $A = 12000$ M1

$2000 = 12000\, e^{-24k}$ OE. M1

$\frac{1}{6} = e^{-24k}$ OR $e^{24k} = 6$ M1

$-24k = \ln\frac{1}{6}$ OR $24k = \ln 6$ M1

$k = -\frac{1}{24}\ln\frac{1}{6}$ $k = \frac{1}{24}\ln 6$ A1

SHOWS THAT $\frac{1}{24}\ln 6 = 0.07466$ A1

(b) $1000 = 12000\, e^{-0.07466t}$ M1

$\frac{1}{12} = e^{-0.074466t}$ OR $12 = e^{0.07466t}$ M1

$0.07466t = \ln 12$ OR $-0.07466t = -\ln\frac{1}{12}$ M1

AWRT $(t \simeq) 33.3$ A1

6. $y^3 + y\ln y = x$ M1

$\frac{dx}{dy} = 3y^2 + 1 \times \ln y + y \times \frac{1}{y}$

OR B4 −1 eeoo

$\frac{dx}{dy} = 3y^2 + \ln y + 1$

$\frac{dy}{dx} = \frac{1}{3y^2 + \ln y + 1}$ A1

$\left(\left.\frac{dy}{dx}\right|_{y=1}\right) = \frac{1}{4}$ A1

SIGHT OF -4 AS GRADIENT M1 ft

$y - 1 = -4(x-1)$ M1

SIMPLIFIES CONVINCINGLY TO $4x+y=5$ A1

7. $\underbrace{\frac{12}{13} \times \frac{4}{5} + \left(\frac{-5}{13}\right)\left(\frac{3}{5}\right)}_{M1}$

A1 B1 B1

OR $\cos A = -\frac{5}{13}$

OR $\sin B = \frac{3}{5}$

8. (a) $2e^{2x} - 4e^{x} - 16x = 0$

B2 -1 eeoo

M1 ft

DIVIDES BY TWO & STATES ANSWER

A1 dep

(b) $(e^{x}+2)(e^{x}-4)=0$

OR

$(\text{"}a\text{"}+2)(\text{"}a\text{"}-4)=0$

M1

$e^{x} = -2,\ 4$

A1

$x = \ln 4$ OR $x = 2\ln 2$ A1

$y = e^{2(\dots)} - 4e^{(\dots)} - 16(\dots)$

OR

$y = 16 - 4\times 4 - 32\ln 2$ oe.

M1

$y = -32\ln 2$ OR $-16\ln 4$ A1

9. (a)

$$\frac{dy}{dx} = \frac{\overset{B1}{\boxed{(x^3-x^2+5)\times 3}} - \overset{B1}{\boxed{(3x+1)(3x^2-2x)}}}{(x^3-x^2+5)^2}$$

$$\frac{(\ldots) - (\ldots)}{(x^3-x^2+5)^2} \quad B1$$

$$\frac{-6x^3+2x+15}{(x^3-x^2+5)^2} \quad A1$$

$$\frac{-6x^3+2x+15}{(x^3-x^2+5)^2} = 0 \quad \text{OR} \quad -6x^3+2x+15=0 \quad M1 \text{ ft}$$

$$6x^3 = 2x+15 \quad M1$$

$$x^3 = \frac{2}{6}x + \frac{15}{6} \quad \text{OR} \quad x^3 = \frac{1}{3}x + \frac{5}{2} \quad M1$$

$$x = \sqrt[3]{\frac{1}{3}x + \frac{5}{2}} \quad A1$$

dep

b)

$$x_{n+1} = \sqrt[3]{\frac{1}{3}x_n + \frac{5}{2}} \quad B1$$

STARTS AT 1.4 B1 (OR "CLOSE BY")

SHOWS 1.43898... AT LEAST 4 d.p A1

(1.439, 0.900) OR IMPLIES THAT "1.43898..." SUBSTITUTED INTO y

OR

A1 ft. A1 ft.