

1.

$$\frac{(x+4)(x-2)}{(x+4)(x-2)} \quad \text{BI}$$

$$\frac{(x+4)(x-2) + (x-8) - 2(x-2)}{(x+4)(x-2)} \quad \text{M1}$$

$$\frac{x^2 + x - 12}{(x+4)(x-2)} \quad \text{M1}$$

$$\frac{(x+4)(x-3)}{(x+4)(x-2)} \quad \text{M1}$$

$$\frac{x-3}{x-2} \quad \text{OR} \quad \begin{matrix} p=3 \\ q=2 \end{matrix} \quad \text{A1}$$

2. a) $\ln(2x-1) = 4-y$ M1

$$2x-1 = e^{4-y} \quad \text{M1}$$

$$x = \frac{1}{2}(1 + e^{4-y}) \quad \text{o.e.} \quad \text{A1}$$

$$f'(x) = \frac{1}{2}(e^{4-x} + 1) \quad \text{o.e.} \quad \text{A1}$$

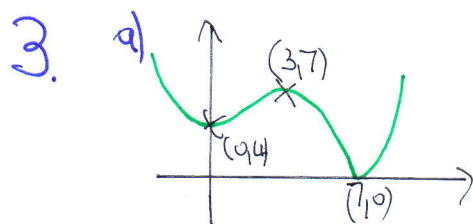
b) $f(4)$ OR $4 - \ln 1$ M1

$$4 - \ln 7 \quad \text{c.a.o.} \quad \text{A1}$$

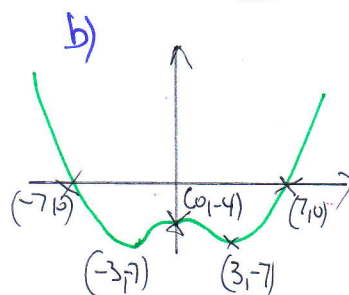
c) $4 - \ln(2x-1) = "f(f(1))"$ M1 A1

$$2x-1 = 7 \quad \text{M1}$$

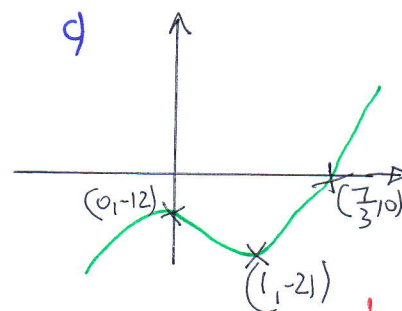
$$x = 4 \quad \text{c.a.o.} \quad \text{A1}$$



• CORRECT SHAPE BI
 • ALL THREE CO-ORDINATES CORRECT A1 dep



• CORRECT SHAPE BI dep
 • ALL FIVE CO-ORDINATES CORRECT A1



CORRECT SHAPE BI dep
 • ALL THREE CO-ORDINATES CORRECT A2 dep
 -12, 0, 7

4. a) $\sqrt{5}$ sec or $\sin x = \frac{1}{\sqrt{5}}$ M1
 $\csc x = \sqrt{5}$ A1

b) $\frac{\tan x + \tan y}{1 - \tan x \tan y} = 2$ or $\frac{\frac{1}{2} + \tan y}{1 - \frac{1}{2} \tan y} = 2$ M1
 $\frac{1}{2} + \tan y = 2(1 - \frac{1}{2} \tan y)$ M1
 $\tan y = \frac{3}{4}$ A1

5. a) 18 A1

b) $14 = 10 + 8e^{-\frac{1}{12}t}$ M1

$\frac{1}{2} = e^{-\frac{1}{12}t}$ or $2 = e^{\frac{1}{12}t}$ M1

$-\frac{1}{12}t = \ln \frac{1}{2}$ or $\frac{1}{12}t = \ln 2$ M1

$t = 12 \ln 2$ or $t = 8.317...$ A1

08:19 A1

c) $\left(\frac{dv}{dt}\right) = -\frac{8}{12}e^{-\frac{1}{12}t}$ o.e. M1

$\left(\frac{dv}{dt}\right)_{t=12} = -\frac{2}{3}e^{-\frac{1}{12} \times 12}$ M1

$-0.245...$ A1

MINUS = DECELERATE B1

d) 10 B1

6. a)

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

M1 (PRODUCT STRUCTURE)
A2

EXPANDS CORRECTLY OR FACTORISES e^{2x}

$$\text{f.g. } 2x^2e^{2x} - 8xe^{2x} - 4e^{2x} + 2xe^{2x} - 4e^{2x}$$

$$\text{OR } e^{2x}[2(x^2-4x-2) + (2x-4)]$$

M1

SIMPLIFIES CORRECTLY TO ANSWER $2e^{2x}(x^2-3x-4)$ A1

b)

$$x^2-3x-4=0 \quad \text{OR} \quad 2e^{2x}(x^2-3x-4)=0 \quad \text{M1}$$

$$(x+1)(x-4)$$

M1

$$(-1, 3e^{-2}) \quad (4, 2e^8) \quad \text{OR EXACT EQUIVALENT}$$

A2

7. a)

$$\left(\frac{dy}{dx}\right) = \frac{1}{2}(e^{2x}-2)^{-\frac{1}{2}}(2e^{2x}-2)$$

A1

LAST MARK IS
ALL CORRECT
WITH CORRECT
BRACKETTING

$$\frac{e^{2p}-1}{\sqrt{e^{2p}-2p}} \quad \text{OR "THAT" } \frac{dy}{dx} \Big|_{x=p}$$

M1/ft

$$P(p, (e^{2p}-2p)^{\frac{1}{2}}) \quad \text{OR} \quad (x, (e^{2x}-2x)^{\frac{1}{2}})$$

B1

MUST BE IN CO-ORDS
OR $y = (e^{2p}-2p)^{\frac{1}{2}}$
ONLY

$$y - (e^{2p}-2p)^{\frac{1}{2}} = \frac{e^{2p}-1}{(e^{2p}-2p)^{\frac{1}{2}}}(x-p)$$

M1

ABOUT EQUATION WRITTEN WITH $x=y=0$

M1

SIMPLIFIES CORRECTLY TO THE ANSWER $(1-x)e^{2x}=x$ A1 (MAY BE IN p)

b)

$$(1-x)e^{2x}-x=0 \quad \text{OR} \quad x-(1-x)e^{2x}=0 \quad \text{OR} \quad f(x)=\pm[(1-x)e^{2x}-x]$$

B1

$$f(0.8)=0.1906... \quad \text{OR} \quad f(1)=-1$$

M1

CONCLUDES CORRECTLY WITH REFERENCE TO CHANGE OF SIGN

E1

c) $\alpha_1 = 0.838$ AI

$\alpha_4 = 0.844$ AI

d) ATTEMPTS $f(0.84385) = \pm 0.00046$ } M1
 $f(0.84395) = \mp 0.000014$ }

CONCLUDES CORRECTLY WITH
 REFERENCE TO SIGN AI

ALTERNATIVE

SHOWS α_1 ---
 To 5/d.p

e.g. 0.83848

0.84325

0.84386

0.84394

0.84395

$0.84395 - 0.843947$

$0.84395 - 0.843947$

CONVINCINGLY AVOIDS CASE EI

8. a) $R \cos 2\cos \alpha - R \sin 2\sin \alpha$ M1

$R = 2$ or IMPROD AI

$\alpha = \frac{\pi}{6}$ or IMPROD AI

b) (MAX IS) 2 (MUST BE CLEAR) B1

$\alpha + \frac{\pi}{6} = 0$ M1

$\alpha = \frac{11\pi}{6}$ AI

c) (D_{\max} IS) IS (MUST BE CLEAR) B1

$\frac{\pi t}{6} = \frac{11\pi}{6}$ M1

$t = 11$ or $t = 23$ or $11:00$ or $23:00$ AI

d) $12 = 13 + 2 \cos(\frac{\pi t}{6} + \frac{\pi}{6})$ M1

$\cos(\frac{\pi t}{6} + \frac{\pi}{6}) = -\frac{1}{2}$ AI

$\frac{\pi t}{6} + \frac{\pi}{6} = \frac{2\pi}{3}$ M1

$\frac{\pi t}{6} + \frac{\pi}{6} = \frac{4\pi}{3}$ M1

$t = 3, 7, 15, 19$ or IN 24 CLOCK NOTATION AI

ANY 2 CORRECT
 AWARDED M1