[2] FIRST CURVE

$$\frac{d}{dx}\left(e^{-2x}\cos 2y + x^2 - y^2\right) = \frac{d}{dx}(1)$$

8 $$-\cancel{2}e^{-2x}\cos 2y - \cancel{2}e^{-2x}\sin 2y\,\frac{dy}{dx} + \cancel{2}x - \cancel{2}y\,\frac{dy}{dx} = 0$$

2 $$x - e^{-2x}\cos 2y = \left(e^{-2x}\sin 2y + y\right)\frac{dy}{dx}$$

2 $$\frac{dy}{dx} = \frac{x - e^{-2x}\cos 2y}{y + e^{-2x}\sin 2y}$$

SECOND CURVE

$$\frac{d}{dx}\left(e^{-2x}\sin 2y - 2xy\right) = \frac{d}{dx}1$$

8 $$-\cancel{2}e^{-2x}\sin 2y + \cancel{2}e^{-2x}\cos 2y\,\frac{dy}{dx} - \cancel{2}y - \cancel{2}x\,\frac{dy}{dx} = 0$$

2 $$\left(e^{-2x}\cos 2y - x\right)\frac{dy}{dx} = e^{-2x}\sin 2y + y$$

2 $$\frac{dy}{dx} = \frac{e^{-2x}\sin 2y + y}{e^{-2x}\cos 2y - x}$$

$$= -\frac{1}{\dfrac{x - e^{-2x}\cos 2y}{y + e^{-2x}\sin 2y}}$$

8 SLOPES ARE NEGATIVE RECIPROCALS

SO TANGENT LINES ARE PERPENDICULAR

[3] [a] $$\frac{d^3}{dx^3}\,\frac{\frac{1}{\cos x}-\sin x}{\frac{\sin x}{\cos x}} = \frac{d^3}{dx^3}\left(\frac{1}{\cos x}-\sin x\right)\cdot\frac{\cos x}{\sin x}$$

$$= \frac{d^3}{dx^3}(\csc x - \cos x)$$

4

$$= \frac{d^2}{dx^2}(-\csc x \cot x + \sin x)$$

4

$$= \frac{d}{dx}(\csc x \cot x \cot x - \csc x(-\csc^2 x) + \cos x)$$

6

$$= \frac{d}{dx}(\csc x \cot^2 x + \csc^3 x + \cos x)$$

2

$$= -\csc x \cot x \cot^2 x + \csc x(2\cot x)(-\csc^2 x) + 3\csc^2 x(-\csc x \cot x) - \sin x$$

8

$$= -\csc x \cot^3 x - 5\csc^3 x \cot x - \sin x$$

4

[b] $y = \dfrac{(x^4-2x+1)^{\frac{1}{3}}(\sec x)^4}{e^{x^2}\arcsin x}$

8 $\ln y = \frac{1}{3}\ln(x^4-2x+1) + 4\ln(\sec x) - x^2 - \ln(\arcsin x)$

$\frac{1}{y}\frac{dy}{dx} = \frac{1}{3}\frac{1}{x^4-2x+1}(4x^3-2) + 4\frac{1}{\sec x}\sec x\tan x - 2x$

2 6 6 2

$- \frac{1}{\arcsin x}\frac{1}{\sqrt{1-x^2}}$

6

$= \dfrac{4x^3-2}{3(x^4-2x+1)} + 4\tan x - 2x - \dfrac{1}{\sqrt{1-x^2}\arcsin x}$

$$\boxed{\frac{dy}{dx} = \frac{\sqrt[3]{1-2x+x^4}\sec^4 x}{e^{x^2}\sin^{-1}x}\left[\frac{4x^3-2}{3(1-2x+x^4)} + 4\tan x - 2x - \frac{1}{\sqrt{1-x^2}\sin^{-1}x}\right]}$$

6

[4] [a] $f(x) = x^{-\frac{1}{3}} \longrightarrow f'(x) = -\frac{1}{3}x^{-\frac{4}{3}}$ 2

$$f'(8) = -\frac{1}{3}(8)^{-\frac{4}{3}} = -\frac{1}{3}\,\frac{1}{(\sqrt[3]{8})^4} = -\frac{1}{3}\,\frac{1}{16} \quad 2$$

$$= -\frac{1}{48} \quad 2$$

$$dy = -\frac{1}{48}(8.06-8) = -\frac{1}{\cancel{48}_{8}}\cdot\frac{\cancel{6}}{100} = -\frac{1}{800}$$

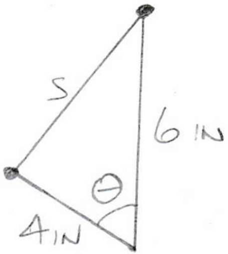
4 2

[b] $y = 8^{-\frac{1}{3}} = \frac{1}{\sqrt[3]{8}} = \frac{1}{2}$ 2

$$\frac{1}{\sqrt[3]{8.06}} \approx \frac{1}{2} - \frac{1}{800} = \frac{399}{800}$$

4 2

[5]



$$\frac{d\Theta}{dt} = \frac{-2\pi \text{ RADIANS}}{\text{HOUR}}$$ 4

WANT $\left.\frac{ds}{dt}\right|_{\Theta=\frac{\pi}{3}}$

8 $$s^2 = (6\text{ IN})^2 + (4\text{ IN})^2 - 2(6\text{ IN})(4\text{ IN})\cos\Theta$$

$$= (52 - 48\cos\Theta)\text{ IN}^2 \leftarrow \Theta = \frac{\pi}{3}$$

$$s^2 = (52 - 48\cdot\tfrac{1}{2})\text{ IN}^2$$

$$= 28\text{ IN}^2$$

$$s = 2\sqrt{7}\text{ IN}$$ 4

6 $$2s\frac{ds}{dt} = (48\sin\Theta)\frac{d\Theta}{dt}\text{ IN}^2$$

6 $$\cancel{2}(2\sqrt{7}\text{ IN})\left.\frac{ds}{dt}\right|_{\Theta=\frac{\pi}{3}} = \overset{12}{\cancel{48}}\cdot\frac{\sqrt{3}}{\cancel{2}}\cdot\frac{-2\pi\ \cancel{\text{RADIANS}}}{\text{HR}}\text{ IN}^{\cancel{2}}$$

$$\left.\frac{ds}{dt}\right|_{\Theta=\frac{\pi}{3}} = \frac{-12\sqrt{3}\pi}{\sqrt{7}}\ \frac{\text{IN}}{\text{HR}} = \frac{-12\sqrt{21}\pi}{7}\ \frac{\text{IN}}{\text{HR}}$$ 4

THE TIP OF THE MINUTE HAND IS GETTING CLOSER TO THE CRYSTAL BY $\frac{12\sqrt{21}\pi}{7}$ INCHES PER HOUR 4

OR $\frac{\sqrt{21}\pi}{35}$ INCHES PER MINUTE AT 8:50 PM

[6] $x=5 \longrightarrow y = \arctan \frac{m(5)}{2(5)-11} = \arctan \frac{1}{-1} = \arctan(-1) = \underline{-\frac{\pi}{4}}$ 4

$$\frac{dy}{dx} = \underset{4}{\boxed{\frac{1}{1+\left(\frac{m(x)}{2x-11}\right)^2}}} \cdot \boxed{\frac{m'(x)(2x-11) - m(x)\cdot 2}{(2x-11)^2}}\ 8$$

$$\left.\frac{dy}{dx}\right|_{x=5} = \underset{4}{\boxed{\frac{1}{1+\left(\frac{1}{-1}\right)^2} \cdot \frac{3(-1)-1(2)}{(-1)^2}}} = \frac{1}{2} \cdot \frac{-5}{1} = \underset{2}{\boxed{-\frac{5}{2}}}$$

SLOPE OF NORMAL LINE $= -\frac{1}{-\frac{5}{2}} = \underset{4}{\boxed{\frac{2}{5}}}$

$$y - -\frac{\pi}{4} = \frac{2}{5}(x-5)$$

$$\underset{2}{\boxed{y + \frac{\pi}{4} = \frac{2}{5}(x-5)}}$$