27.8

17 $y = x^2 \ln x$

$y' = x^2\left(\frac{1}{x}\right) + (\ln x)(2x)$

$y'\big|_{x=1} = 1 + 0$

$= 1$

$\boxed{m=1, \quad x_1 = 1, \; y_1 = 0}$

$y - y_1 = m(x - x_1)$

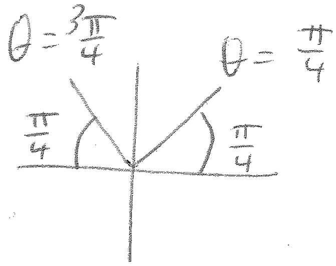
$y = 1(x-1)$

$y = x - 1$

(19) $y = 2\sin\frac{x}{2}$

$y' = \left(2\cos\frac{x}{2}\right)\left(\frac{1}{2}\right)$

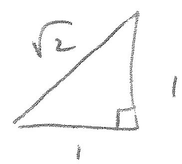
$= \cos\frac{x}{2}$



$y'\Big|_{x=\frac{3\pi}{2}} = \cos\frac{3\pi}{4}$

$= -\cos\frac{\pi}{4}$

$= \frac{-1}{\sqrt{2}}$



$m_{tan} = \frac{-1}{\sqrt{2}}$

$m_{normal} = \sqrt{2}$

$x_1 = \frac{3\pi}{2}$ $\quad$ $y_1 = 2\sin\frac{3\pi}{4}$

$= 2\sin\frac{\pi}{4}$

$= 2\left(\frac{1}{\sqrt{2}}\right)$

$= \sqrt{2}$

$y - y_1 = m(x - x_1)$

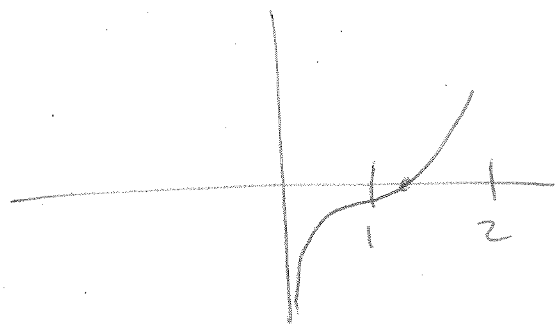
$y - \sqrt{2} = \sqrt{2}\left(x - \frac{3\pi}{2}\right)$

$y - \sqrt{2} = \sqrt{2}x - \frac{3\pi\sqrt{2}}{2}$

or $2y - 2\sqrt{2} = 2\sqrt{2}x - 3\pi\sqrt{2}$

or $0 = 2\sqrt{2}x - 2y + 2\sqrt{2} - 3\pi\sqrt{2}$

(21) Use Wolfram Alpha to make a rough graph of $y = x^2 - 3 + \ln 4x$



Let $x_0 = 1$

$$f(x) = x^2 - 3 + \ln 4x$$

$$f'(x) = 2x + \frac{4}{4x}$$

$$= 2x + \frac{1}{x}$$

x_n	$f(x_n)$	$f'(x_n)$	$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$	
1	-0.6137	3	1.2046	(1.20)
1.2046	0.0235	3.2394	1.1973	(1.20)

$$\boxed{x \approx 1.20}$$

Table to 4 decimal places.
Final answer to 2 decimal places.

(39) The object is moving vertically only (not horizontally). We want $\frac{dy}{dt}$.

$$y = e^{-0.5t}(0.4\cos 6t - 0.2\sin 6t)$$

$$\frac{dy}{dt} = e^{-0.5t}(-2.4\sin 6t - 1.2\cos 6t)$$
$$- 0.5e^{-0.5t}(0.4\cos 6t - 0.2\sin 6t)$$

$$\text{OR } \frac{dy}{dt} = -2.4e^{-0.5t}\sin 6t - 1.2e^{-0.5t}\cos 6t$$
$$-0.2e^{-0.5t}\cos 6t + 0.1e^{-0.5t}\sin 6t$$

$$\text{OR } \frac{dy}{dt} = -2.3e^{-0.5t}\sin 6t - 1.4e^{-0.5t}\cos 6t$$

$$\text{OR } \frac{dy}{dt} = e^{-0.5t}(-2.3\sin 6t - 1.4\cos 6t)$$

$$\text{OR } \frac{dy}{dt} = -e^{-0.5t}(2.3\sin 6t + 1.4\cos 6t)$$

$$\left.\frac{dy}{dt}\right|_{t=0.26} = -e^{-0.13}(2.3\sin 1.56 + 1.4\cos 1.56)$$
$$\approx -2.03 \text{ cm/s}$$