Quiz 5 Key

1a) $y = \dfrac{5^{-2x}}{x}$ Use quotient rule

$$y' = \frac{5^{-2x} \cdot -2 \cdot \ln 5 \cdot x - 1 \cdot 5^{-2x}}{x^2}$$

$$= \boxed{\frac{-2 \ln 5 \cdot 5^{-2x} - 5^{-2x}}{x^2}}$$

<u>Note</u> You can't combine 2 with 5^{-2x}.
Think of it as $2(5^{-2x})$

b) $f(x) = \ln(8-x)$ I changed the argument from $|8-x|$ since we'd have to differentiate two branches of $\ln|8-x|$. But I marked it as $(8-x)$

$$f'(x) = \frac{1}{8-x} \cdot (-1)$$

$$\boxed{f'(x) = \frac{-1}{8-x}}$$

2a) $y = x^3 - \dfrac{2}{x} = x^3 - 2x^{-1}$

$y' = 3x^2 + 2x^{-2}$

$y'' = 6x - 4x^{-3}$

b) $f(x) = e^{2x}$ $f'(x) = 2e^{2x}$ $f''(x) = 2 \cdot 2e^{2x}$

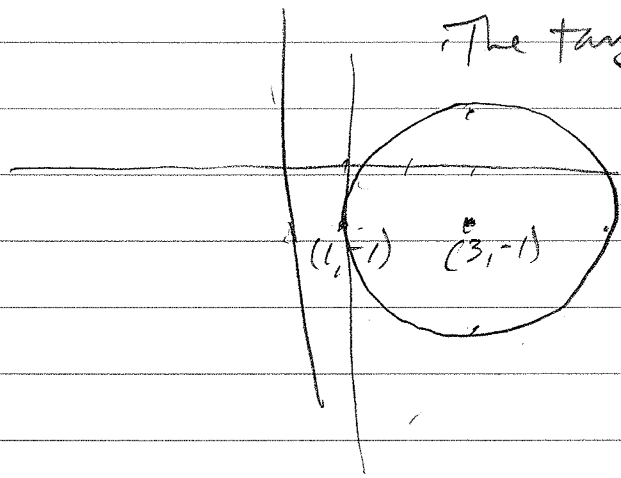
$\ldots f^{(5)}(x) = 2^5 e^{2x}$, $f^{(n)}(x) = 2^n e^{2x}$

Find by implicit differentiation:

3. $\left.\frac{dy}{dt}\right|_{(1,-1)}$ for the circle below:

$$(x-3)^2 + (y+1)^2 = 4$$

Center $(3,-1)$
radius $= 2$



The tangent at $(1,-1)$ has an undef. slope, so expect that $\left.\frac{dy}{dt}\right|_{(1,-1)}$ DNE.

$$\underbrace{2(x-3) + 2(y+1)\frac{dy}{dt}}_{\text{the implicit step}} = 0$$

Isolate dy/dt:

$$\frac{dy}{dt} = \frac{-\cancel{2}(x-3)}{\cancel{2}(y+1)}$$

$$\left.\frac{dy}{dt}\right|_{(1,-1)} = \frac{-(1-3)}{(-1+1)} = \frac{2}{0} \quad \text{undefined}$$

so dy/dt DNE at $(1,-1)$