4.4 day 1

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2. $y = e^{2x}$

$\frac{dy}{dx} = 2e^{2x}$

4. $y = e^{-5x}$

$\frac{dy}{dx} = -5e^{-5x}$

6. $y = e^{-x/4}$

$\frac{dy}{dx} = \frac{-1}{4}e^{-x/4}$

8. $y = x^2e^x - xe^x$

$= e^x(x^2 - x)$

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

$= e^x(2x - 1 + x^2 - x)$

$= e^x(x^2 + x - 1)$

10. $y = e^{x^2}$

$\frac{dy}{dx} = e^{x^2} \cdot 2x$

$= 2xe^{x^2}$

16. $y = (\ln x)^2$

$\frac{dy}{dx} = 2\ln x \cdot \frac{1}{x}$

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

18. $y = \ln(10/x) = \ln(10x^{-1})$

$\frac{dy}{dx} = \frac{1}{10x^{-1}} \cdot -10x^{-2}$

$= -x^{-1}$

$= \frac{-1}{x}$, $x > 0$

20. $y = x\ln x - x$

$\frac{dy}{dx} = x \cdot \frac{1}{x} + \ln x \cdot 1 - 1$

$= \ln x$

30. $y = 2e^x - 1$

$y' = 2e^x$ slope of $y = -3x + 2$

$2e^x = \frac{1}{3}$ ← use ⊥ slope

$e^x = \frac{1}{6}$

$\ln \frac{1}{6} = x$

$y = 2e^{\ln 1/6} - 1 = 2 \cdot \frac{1}{6} - 1 = \frac{-1}{3}$

$\left(\ln \frac{1}{6}, \frac{-1}{3}\right)$

31. $y = \ln(2x)$

$y' = \frac{1}{2x} \cdot 2 = \frac{1}{x} = m$

If the line passes through (0,0), then its equation is $y = mx$. But @ the point of tangency, $y = \ln(2x)$.

so $\ln(2x) = mx$

$\ln(2x) = \frac{1}{x} \cdot x$

$\ln(2x) = 1$

$2x = e$

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

So $m = \frac{2}{e}$

37. $f(x) = \ln(x+2)$ $x > -2$

$f'(x) = \frac{1}{x+2} \cdot 1$

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

40. $f(x) = \ln(x^2+1)$ all real x

$f'(x) = \frac{1}{x^2+1} \cdot 2x$

$= 2x$ all real x

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

Domain of f' is $x > -2$

$= \frac{2x}{x^2+1}$ all real x

Domain of f' is all reals

52. $P(t) = \frac{200}{1+e^{5-t}}$

a. $P(0) = \frac{200}{1+e^5} \approx 1.34$ An estimate is $P(0) = 1$ person

b. $P'(t) = \frac{(1+e^{5-t}) \cdot 0 - 200e^{5-t} \cdot -1}{(1+e^{5-t})^2}$

$= \frac{200e^{5-t}}{(1+e^{5-t})^2}$

$P'(4) = \frac{200e}{(1+e)^2} = 39.32 \frac{\text{people}}{\text{day}}$

59. B