HW 8 - MA 131

Section 4.2

9.) $\frac{d}{dx}(e^x)^{10} = 10(e^x)^9 e^x = 10e^{9x}e^x = 10e^{10x}$

12.) $\frac{d}{dx}(e^x + x^2) = e^x + 2x$

20.) $1 - x = 2$

$-x = 1$

$x = -1$

28.) $y' = (2x+1)e^x + (x^2+x+1)e^x = (x^2+3x+2)e^x$

32.) $y' = \frac{e^x(1) - (x+1)e^x}{e^{2x}} = \frac{e^x - xe^x - e^x}{e^{2x}}$

$y' = \frac{-xe^x}{e^{2x}} = \frac{-x}{e^x}$

46.a) $f(18) = 27e^{.106 \cdot 18}$

≈ 182 billion

b) $f'(t) = 27 \cdot .106e^{.106t} = 2.862e^{.106t}$

$f'(12) = 2.862e^{.106 \cdot 12} \approx 10.2 \frac{\text{billion \$}}{\text{year}}$

c) $120 = 27e^{.106t}$

$4.44 = e^{.106t}$

$\ln 4.44 = .106t$

$\frac{\ln 4.44}{.106} = t$

$t \approx 14.1$

$\boxed{\text{Around } 1974}$

d) $20 = 2.862e^{.106t}$

$6.98 = e^{.106t}$

$\ln 6.98 = .106t$

$18.33 = t$

$\boxed{\text{Around } 1978}$

Section 4.3

2.) $f'(x) = 0$

4.) $f'(x) = e^{3x}$

6.) $f'(t) = e^{-t} - te^{-t} = (1-t)e^{-t}$

8.) $f'(x) = 2 \cdot \frac{1}{2\sqrt{x}} e^{\sqrt{x}} = \frac{1}{\sqrt{x}} e^{\sqrt{x}}$

14.) $f'(x) = \dfrac{(e^{2x}+1)(2e^{2x}) - (e^{2x}-1)(2e^{2x})}{(e^{2x}+1)^2}$

$= \dfrac{2e^{4x} + 2e^{2x} - 2e^{4x} + 2e^{2x}}{(e^{2x}+1)^2}$

$= \dfrac{4e^{2x}}{(e^{2x}+1)^2}$

28.) $f'(x) = 2(1-x)e^{2x} - e^{2x}$

$= (2-2x-1)e^{2x}$

$= (1-2x)e^{2x}$

$\dfrac{0}{e^{2x}} = \dfrac{(1-2x)e^{2x}}{e^{2x}}$

$0 = 1-2x$

$2x = 1$

$x = 1/2$

$f''(x) = 2(1-2x)e^{2x} - 2e^{2x}$

$= (2-4x-2)e^{2x} = -4xe^{2x}$

$f''(1/2) = -2e^{1} < 0$

$\boxed{\text{Relative max at } x = 1/2}$

34.) $v'(t) = 2000(-.35)e^{-.35t} = -700e^{-.35t}$

$v'(3) = -700e^{-1.05} \approx -2.44$

$\boxed{244 \text{ dollars}/\text{year}}$

35. a) $f(8) \approx 45$ m/s

b) $f'(0) = 10$ m/s^2

c) $f(4) = 30$ m/s $\qquad \underline{t = 4}$

d) $f'(4) = 5$ m/s^2 $\qquad \underline{t = 4}$

<u>Section 4.4</u>

3.) $e^x = 5 \longrightarrow \boxed{x = \ln 5}$

4.) $e^{-x} = 3.2$

$-x = \ln 3.2$

$\boxed{x = -\ln 3.2}$

6.) $\boxed{x = e^{4.5}}$

8.) 4.1

12.) $e^{4\ln 1} = (e^{\ln 1})^4 = 1^4 = 1$

39.) $f'(x) = -5 + e^x$

$0 = -5 + e^x$

$5 = e^x$

$\ln 5 = x$

$f(\ln 5) = -5\ln 5 + 5 = 5(1 - \ln 5)$

$\boxed{\text{Coordinates of Minimum: } (\ln 5,\ 5(1-\ln 5))}$

40.) $f'(x) = 2(x-1)e^x + (x-1)^2 e^x$

$0 = (2 + x - 1)(x-1)e^x$

$0 = (1 + x)(x-1)e^x$

$x = -1, \ x = 1$

$f(1) = 1$

$f(-1) = 1 + 4e^{-1}$

$\boxed{\begin{array}{l} \text{Max: } (-1, -1 + 4/e) \\ \text{Min: } (1, -1) \end{array}}$

45.) $f'(t) = 5(-.01e^{-.01t} + .51e^{-.51t})$

$$0 = -.01e^{-.01t} + .51e^{-.51t}$$

$$\left(\frac{e^{.51t}}{.01}\right) .01e^{-.01t} = .51e^{-.51t}\left(\frac{e^{.51t}}{.01}\right)$$

$$e^{.5t} = 51$$

$$.5t = \ln 51$$

$$t = \frac{\ln 51}{.5}$$

$$\boxed{t \approx 7.86}$$