Problem 1. omitted — use Wolfram Alpha to check your answers.

Problem 2. $y = 2x - e$

Problem 3. $A'(t) = 20t \cdot 2^{-t} - 10\ln(2)\, t^2 2^{-t}$
$$= 2^{-t} t \left(20 - 10\ln(2)t\right)$$

Problem 4. a) $R'(x) = 30 \cdot \dfrac{1}{2x+1} \cdot 2 = \dfrac{60}{2x+1}$

b) ~~and so that~~ $P(x) = R(x) - C(x) = 30\ln(2x+1) - \dfrac{x}{2}$.

c) $P'(x) = R'(x) - C'(x) = \dfrac{60}{2x+1} - \dfrac{1}{2}$

$P'(60) = \dfrac{60}{121} - \dfrac{1}{2} = \dfrac{-1}{242}$

d) $P'(60)$ is roughly the change in profit expected from producing 1 additional item, after 60 have already been produced. (i.e., we expect to make slightly less profit if we make an additional item, after we have already made 60).

Problem 5. $P'(t) = \dfrac{t+100}{t+2} + \ln(t+2)$

$P'(8) = \dfrac{54}{5} + \ln(10)$

Problem 6. $\dfrac{dA}{dr} = 120\, e^{3r/25}$. $\left.\dfrac{dA}{dr}\right|_{r=5} = 120\, e^{15/25} \approx 218.654$

If the rate of interest is increased from 5% to 6%, we expect an increase in the balance after 12 years of about \$218.654.

Problem 7. a) $L = 71.5\left(1 - e^{-0.1 \times 5}\right) \approx 28.13$ cm.

b) $\left.\dfrac{dL}{dt}\right|_{t=5} = 7.15\, e^{-0.1t}\Big|_{t=5} \approx 4.37$ cm/year.

c) $W = 0.01289 \cdot (28.13)^{2.9} \approx 205.52$ grams.

d) $\left.\dfrac{dW}{dL}\right|_{L=28.13} = \left(2.9 \times 0.1289\, L^{1.9}\right)\Big|_{L=28.13} \approx 2118.72$ g/cm.

e) $\left.\dfrac{dW}{dt}\right|_{t=5} = \left.\dfrac{dW}{dL}\right|_{L=28.13} \cdot \left.\dfrac{dL}{dt}\right|_{t=5} = (2118.72\ \text{g/cm})(4.37\ \text{cm/year})$
$$= 9258.81\ \text{g/year}.$$