Mathematics 172 Homework, September 11, 2023.

Here are some derivative problems for you to practice. The answers are on the next page.

1. $y = x^3 - 4x$

2. $A = t^3 e^t$

3. $P = be^{rt}$ Where b and r are constants.

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

5. $P = P_0 e^{rt}$ where P_0 and r are constants.

6. $f(x) = x^2 e^{rx}$

7. If $P = a + be^{rt}$ where a, b, and r are constants, show
$$P' = r(P - a)$$

1. $y' = 3x^2 - 4$

2. $\dfrac{dA}{dt} = t^3 e^t + 3t^2 e^t$

3. $P' = bre^{rt}$

4. $y' = 2x + 2e^{2x}$ Note that e^2 is a constant and therefore $(e^2)' = 0$.

5. $\dfrac{dP}{dt} = rP_0 e^{rt}$. Note that as $P = P_0 e^{rt}$ that this implies $\dfrac{dP}{dt} = rP$.

6. $f'(x) = rx^2 e^{rx} + 2xe^{rx}$

7. There are several ways to do this. Here is one. Starting with $P = ae^{rt} + b$ take the derivative to get

$$P' = are^{rt}.$$

In the original equation $P = ae^{rt} + b$ solve for ae^{rt} to get $ae^{rt} = (P-b)$. Plug this into the equation for P' to get

$$P' = r(P - b).$$