1. (2 points each) Using Leibniz notation (i.e., $\frac{dy}{dx}$, $\frac{dP}{dt}$, etc.), find derivatives for each of the following functions.

   (a) $w = 2r^5 - \dfrac{5}{r^3}$

   $$w = 2r^5 - 5r^{-3}$$
   $$\frac{dw}{dr} = 2 \cdot 5r^4 - 5 \cdot -3r^{-4}$$
   $$\frac{dw}{dr} = 10r^4 + 15r^{-4}$$

   (b) $q = 5^t + e^\pi$

   $$\frac{dq}{dt} = \ln 5 \cdot 5^t$$ (since e^π is a constant its derivative is 0)

2. (2 points) Given that $\dfrac{d}{dx}\left(\tan^{-1} x\right) = \dfrac{1}{1+x^2}$ find the derivative of the following function.

$$g(x) = 5x^3 \tan^{-1} x$$
$$g'(x) = \left(5x^3\right)'\left(\tan^{-1} x\right) + \left(5x^3\right)\left(\tan^{-1} x\right)'$$
$$g'(x) = \left(15x^2\right)\left(\tan^{-1} x\right) + \left(5x^3\right)\left(\frac{1}{1+x^2}\right)$$
$$g'(x) = 15x^2 \tan^{-1} x + \frac{5x^3}{1+x^2}$$

3. (2 points) Find the x-value for each point on the graph of $f(x) = 2x^3 + 9x^2 - 60x + 40$ where the tangent line to the curve is horizontal.

$f'(x) = 6x^2 + 18x - 60$

A horizontal line has slope 0 so we set $f'(x) = 0$ to obtain

$6x^2 + 18x - 60 = 0$

$6(x^2 + 3x - 10) = 0$

$6(x + 5)(x - 2) = 0$

$x = -5$ or $x = 2$

Thus there is one horizontal tangent line at $x = -5$ and a second one at $x = 2$.

4. (2 points) Find the derivative of the following function.

$$y = \frac{\sqrt[3]{x} + x^{-2}}{\sqrt{x}}$$

$$y = \frac{\sqrt[3]{x}}{\sqrt{x}} + \frac{x^{-2}}{\sqrt{x}}$$

$$y = \frac{x^{1/3}}{x^{1/2}} + \frac{x^{-2}}{x^{1/2}}$$

$$y = x^{1/3-1/2} + x^{-2-1/2}$$

$$y = x^{-1/6} + x^{-5/2}$$

$$y' = -\tfrac{1}{6}x^{-7/6} - \tfrac{5}{2}x^{-7/2}$$