Worksheet: Differentiating $y = ax^n$

This worksheet has questions about the differentiation using the power rule which allows you to differentiate equations of the form $y = ax^n$. Before attempting the questions below you should be familiar with the concepts in the study guide: Differentiating using the Power Rule.

1. Find $\frac{dy}{dx}$ when $y$ is defined by the following equations:
   - a) $y = 3x^3$
   - b) $y = x^3$
   - c) $y = -2x^2$
   - d) $y = 1.1x^3$
   - e) $y = 7$
   - f) $y = -23.004$
   - g) $y = 0$
   - h) $y = \pi$
   - i) $y = 2x$
   - j) $y = 4 - x$
   - k) $y = \frac{2}{9}x^3$
   - l) $y = -3 + 2x - 4x^3$

2. Find the gradient at the point where $x = 1$ for all of the curves defined in question 1.

3. Find $\frac{dy}{dx}$ when $y$ is defined by the following equations:
   - a) $y = \frac{x^3}{2}$
   - b) $y = \frac{4-x}{3}$
   - c) $y = 2x^{-1}$
   - d) $y = \frac{2}{x}$
   - e) $y = \frac{5}{x^3}$
   - f) $y = \frac{1}{5}x^3$
   - g) $y = \frac{x^3}{5}$
   - h) $y = \frac{1}{5x^3}$
   - i) $y = x^{\frac{1}{2}}$
   - j) $y = \sqrt{x}$
   - k) $y = \frac{3\sqrt{x}}{7}$
   - l) $y = \frac{4 - \frac{5}{3}\sqrt{x}}{3}$
   - m) $y = \frac{2}{\sqrt{x}}$
   - n) $y = \frac{7}{\sqrt{x}}$
   - o) $y = \frac{x^3 - 3}{2} + \frac{3 - x^3}{2}$
4. Differentiate the following:

a) Find \( \frac{dE}{dv} \) where \( E = \frac{1}{2}mv^2 \) and \( m \) is a constant.

b) Find \( \frac{dE}{dP} \) where \( E = \frac{Q}{P} \) and \( Q \) is a constant.

c) Find \( \frac{dE}{dQ} \) where \( E = \frac{Q}{P} \) and \( P \) is a constant.

d) Find \( \frac{dE}{dm} \) where \( E = mc^2 \) and \( c \) is a constant.

e) Find \( \frac{ds}{dt} \) where \( s = ut + \frac{1}{2}at^2 \) and \( u \) and \( a \) are constants.

f) Find \( \frac{dv^2}{ds} \) where \( v^2 = u^2 + 2as \) and \( u \) and \( a \) are constants.

g) Find \( \frac{dy}{dx} \) where \( y = mx + c \) and \( m \) and \( c \) are constants.