

Name: \_\_\_\_\_

1. [6 marks] Differentiate with respect to the given variable:

a)  $f(x) = \frac{1}{x^6}$

b)  $g(v) = \sqrt[7]{v^4}$

c)  $h(t) = \frac{1}{(5t^3 + 6t^2 + 4)^2}$

d) Where is  $h'(t) = 0$ ?2. [4 marks] Find  $\frac{dy}{dx}|_{x=-1}$  for  $y = (4x^3 + 2)^8(7x^4 + 3x)$ .

3. [2 marks] We want to solve  $x^6 + x - 32 = 0$ . Use Newton's Method with  $x_0 = -2$  to find  $x_1$ . Round your answer to two decimal places.

4. [4 marks] A particle's position in metres is given by  $x = 6 + t + t^2, y = \frac{54}{t^2}$ . Find the particle's velocity at  $t = 3$  seconds. Include units in your answer.

5. [4 marks] Find  $f'(x)$  for  $f(x) = (3x^2)\sqrt{5x^7}$ . Simplify your answer.

6. [6 marks] Find the equation of:

a) the tangent line to  $y = \frac{x+2}{x^2+2}$  at the point  $(2, \frac{2}{3})$ . Leave your answer in the form  $ax + by + c = 0$ .

b) the normal line to  $y = \frac{x+2}{x^2+2}$  at the point  $(2, \frac{2}{3})$ . Leave your answer in the form  $ax + by + c = 0$ .

7. [4 marks] Find  $\frac{dy}{dx}$  for the curve  $x^6 + 4y^2 + 2y(x^3 + 1)^5 = 5x$ .