

**Differentiation Formulas**

1. Differentiate :  $f(t) = \frac{1}{12t^5} - \frac{3}{\sqrt[4]{t^5}} + 4t^6 - 9t - 12$

2. Find the equation of the tangent line to  $g(x) = \frac{4-2x}{\sqrt{x}}$  at  $x = 16$ .

3. Find the point(s) where the tangent line to  $f(x) = (x^2 - 2)(4 - 3x)$  is perpendicular to the line  $y = 7 + \frac{1}{4}x$ .

4. The position function of an object is  $s(t) = 2t^3 - 27t^2 + 84t + 25$  where  $t$  is in seconds and  $s$  is in feet. Assume that the object starts moving at  $t = 0$  and answer the following questions.

(a) What is the velocity of the object at any time  $t$ ?

(b) When, if ever, is the object at rest (*i.e.* not moving)?

(c) When is the object moving to the right and when is it moving to the left?

5. For  $f(x) = x^5 - 2x^4 - 14x^3 + 2$  determine the percentage of the range  $[-2, 6]$  that the function is increasing.

**Product and Quotient Rule**

For problems 6 & 7 use the Product or Quotient Rule to find the derivative.

6.  $y = (6x^{-2} - 7x + 3)(1 + 8x^{-1})$

7.  $R(z) = \frac{3z^2 + 4}{1 - 8\sqrt{z}}$

8. The voltage in a rechargeable battery is given by  $V(t) = \frac{3-t}{4t^2 - 2t + 1}$  where  $t$  is in days. Assume that if the voltage is increasing it is being recharged and if the voltage is decreasing then the battery is in use. During the first 8 days is the battery in use more than it's being recharged?

**Derivative of Trig Functions**

For problems 9 & 10 differentiate the given function.

9.  $f(x) = \csc(x) - 2x^6 \cot(x)$

10.  $R(\theta) = \frac{\theta^3 + 6 \tan \theta}{1 - \sec \theta}$

Continued on Back  $\Rightarrow$

11. Is  $h(z) = \frac{4 - 3 \tan z}{1 - 2 \sin z}$  increasing, decreasing or not changing at  $z = 2$ ?

12. Find the equation of the tangent line to  $y = \cos(x)\cot(x)$  at  $x = \frac{\pi}{2}$ .

13. The population of some insects in a field is given by  $P(t) = 5t + 9\sin(t) - 3$  where  $t$  is in months. When in the first 15 months is the population not changing?