2.2 Notes and Examples

Name: Block: Seat:

Basic Differential Rules and Rates of Change

Basic Derivative Rules

1. The Constant Rule: $\frac{d}{dx}[c] =$
2. The Power Rule: $\frac{d}{dx}[x^n] =$
3. The Constant Multiple Rule: $\frac{d}{dx}[cf(x)] =$
4. The Sum Rule: $\frac{d}{dx}[f(x) + g(x)] =$
5. The Difference Rule: $\frac{d}{dx}[f(x) - g(x)] =$
6. The Sinusoidal Functions: $\frac{d}{dx}[\sin x] =$ $\frac{d}{dx}[\cos x] =$
7. The Exponential and Natural Log Functions: $\frac{d}{dx}[e^x] =$ $\frac{d}{dx}[\ln x] =$

1. Let $f(x) = 5$. Find $f'(x)$

2. Let $y = x^9$. Find y'

3. Let $y = \sqrt[3]{t}$. Find $\frac{dy}{dt}$

4. $\frac{d}{dx}\left[\frac{1}{x^3}\right] =$

5. Let $f(x) = 4x^3 + 5\sin x$. $f'(x) =$

6. Let $y = 6x^3 + 4x^2 - 2x - 2\cos x + 5$. Find $\dfrac{dy}{dx}$

7. $\dfrac{d}{dt}\left[3e^t + \sqrt{t} + \dfrac{5}{t^4} - \dfrac{3}{\sqrt[3]{t^2}} - \pi\right] =$

8. Let $y = \dfrac{x^2 - 2\sqrt{x}}{x}$. Find $\dfrac{dy}{dx}$

9. Find the equation of the line tangent to the graph of $f(t) = \sin t + 2t$ at the point $(\pi, 2\pi)$

10. Find the point(s) on the graph of $y = 8x - 2e^x$ that has a horizontal tangent line.

A common use for rate of change to describe the motion of an object moving in a straight line. Movement to the right on a horizontal line or up in a vertical line is considered ______________direction, and movement to the left on horizontal line or down on a vertical line is considered is the ______________ direction. The function $s(t)$ that gives the position (relative to the origin) of an object as a function of time t. is called a ______________ ______________

Rates of Change of a Position

1. Average Velocity:
2. (Instantaneous) Velocity: $v(t) =$
3. Acceleration: $a(t) =$

11. The position of an object (starting from rest) is given by $5t^2$, where the position is measured in cm and the time is measured in minutes.
   (a) Find the average velocity for the time $t = 1$ to $t = 3$

   (b) Find the velocity at time $t = 2$

   (c) Is the acceleration constant? What is the acceleration ?

12. A common use is in modeling projectile motion: $s(t) = \frac{1}{2}gt^2 + v_0t + s_0$, where g is the gravitational acceleration (on Earth -32 feet per second per second, or -9.8 meters per second per second).

A diver jumps from a platform diving board that is 32 feet above the water. The initial velocity ($v_0 = 16$) feet per second

(a) $s(t) =$

(b) When does the diver hit the water?

(c) What was the average velocity over the time from $t = 1$ to $t = 2$?

(d) What is the diver's velocity at impact?