**3.1 Two Problems with One Theme**

* Determine the slope of a line tangent to a curve.
* Determine the average velocity and instantaneous velocity of an object.

**Vocabulary:** tangent line, average velocity, instantaneous velocity

**Concepts:**

**Definition: Tangent Line**

The tangent line to the curve  at the point *P*(*c*, *f* (*c*)) is that line through *P* with slope  provided that this limit exists and is not  or .

**Definition: Instantaneous Velocity**

If an object moves along a coordinate line with position function , then its instantaneous velocity at time *c* is  provided that the limit exists and is not  or .

**Examples:**

1. Find the slope of the tangent line to the curve  at the point (2, 4).
2. Find the slopes of the tangent lines to the curve  at the points with *x*-coordinates -1, ½ , 2 and 3.
3. Find the equation of the tangent line to the curve at (2, ½ ),
4. An object, initially at rest, falls due to gravity Find its instantaneous velocity at  seconds and at  seconds.
5. How long will it take the falling object of Example 4 to reach an instantaneous velocity of 112 feet per second.
6. A particle moves along a coordinate line and *s*, its directed distance in centimeters from the origin at the end of *t* second, is given by . Find the instantaneous velocity of the particle at the end of 3 seconds.

**Concepts Review:**

1. The line that most closely approximates a curve near the point *P* is the line through that point.
2. More precisely, the tangent line to a curve at *P* is the limiting position of the line through *P* and *Q* as *Q* approaches *P* along the curve.
3. The slope  of the tangent line to the curve  at  is given by  .
4. The instantaneous velocity of a point *P* (moving along a line) at time *c* is the limit of the on the time interval *c* to  as *h* approaches zero.

**Assignment:**

p. 105 – 106 / 7e, p – 15 odd, 21