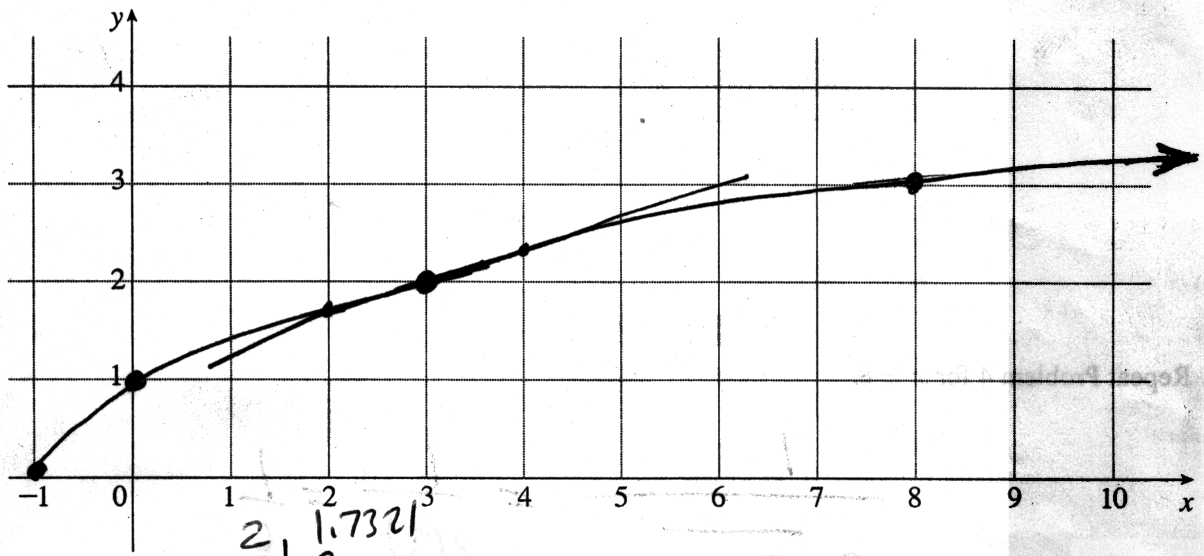
Group Work 1, Section 2.1
What's the Pattern?

Consider the function $f(x) = \sqrt{1+x}$.

1. Carefully sketch a graph of this function on the grid below.



2	1.7321
3	2
4	2.24
5	2.45
2.5	1.8708
2.8	1.9494
3.5	2.1213

$3.2 \to 2.0494$

$3.4 \Rightarrow 2.0976$

2. Sketch the secant line to f between the points with x-coordinates $x = 2$ and $x = 4$.

3. Compute the slopes of the secant lines to f between the pairs of points with the following x-coordinates:

(a) $x = 2$ and $x = 3$

$m = \frac{2-1.7321}{3-2} = 0.2679$

(b) $x = 3$ and $x = 4$

0.24

(c) $x = 2.5$ and $x = 3.5$

0.2505

(d) $x = 2.8$ and $x = 3.2$

0.25

$\frac{2.0494-1.9494}{0.4} = 0.25$

4. Using the slopes you've found so far, estimate the slope of the tangent line at $x = 3$.

$$\frac{1}{2\sqrt{3+1}} = \frac{1}{4} = 0.25$$

5. Repeat Problem 4 for $x = 8$.

$$\frac{1}{2\sqrt{8+1}} = \frac{1}{2(3)} = \frac{1}{6}$$

6. Based on Problems 4 and 5, guess the slope of the tangent line at any point $x = a$, for $a > -1$.

$$\frac{1}{2\sqrt{a+1}}$$

Group Work 2, Section 2.1
Slope Patterns

1. (a) Estimate the slope of the line tangent to the curve $y = 0.1x^2$, where $x = 0, 1, 2, 3$. Use your information to fill in the following table:

x	slope of tangent line
0	0
1	0.2
2	0.4
3	0.6

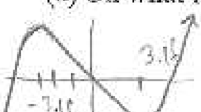
$\left\{\begin{matrix}(1, 0.1)\\(1.00001, 0.100002)\end{matrix}\right\}$ $m = \frac{y_2 - y_1}{x_2 - x_1} = 0.2$

(b) You should notice a pattern in the above table. Using this pattern, estimate the slope of the line tangent to $y = 0.1x^2$ at the point $x = 57.5$.

(57.5, 330.625)
(57.500001, 330.62501)
$\Rightarrow m = \frac{330.62501 - 330.625}{57.500001 - 57.5} \approx 10$

2. Consider the function $f(x) = 0.1x^3 - 3x$.

(a) On what intervals is this function increasing? On what intervals is it decreasing?



$(-\infty, -3.16) \cup (3.16, \infty)$ $(-3.16, 3.16)$

(b) On what interval or intervals is the slope of the tangent line positive? On what interval or intervals is the slope of the tangent line negative? What is the connection between these questions and part (a)?

$(-\infty, -3.16) \cup (3.16, \infty)$ $(-3.16, 3.16)$

(c) Where does the slope of the tangent line appear to be zero? What properties of the graph occur at these points? at $x = -3.16$ and at $x = 3.16$

these are the local Maximum & local Minimum point of the graph.

(d) Where does the tangent line appear to approximate the curve the best? The worst? What properties of the graph seem to make it so?

The tangent line approximates the curve worst at the Maximum and the minimum.

It approximates best at $x = 0$ where the curve is "straightest"

this point is also called the point of Inflection