1.1 LINES

Notecards from Section 1.1: Rules for Rounding
Round or Truncate all final answers to 3 decimal places. Do NOT round before you reach your final answer.

Much of Calculus focuses on the concept of "local linearity", meaning that even if a function curves, if you were to pick a point and stay very close (local) to that point, the function behaves very much like that of a line.

Example 1: Graph the functions $y = \sin x$ and $y = x$ on your calculator. Obviously these are not the same function. However, if you were to stay close to the point (0, 0), these two functions are very close. To see this, use the ZOOM feature of your calculator, and zoom in on (0, 0). Try zooming in more than once.

We can say that as long as we stay "close" to (0, 0), the functions $y = \sin x$ and $y = x$ are almost the same thing. Now, the concept of "close" is more complicated than it might sound, but more on that in chapter 2. For now, we focus on lines.

As stated in the syllabus, calculus has to do with change. For notational purposes, we use the capital Greek letter delta, Δ.

Slope

The slope of a non-vertical line is given by

$$\frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

A vertical line has _____, and a horizontal line has _____ .

Parallel Lines have slopes that are _____ .

Perpendicular Lines have slopes that are _____.

IMPORTANT ♫: You will be best served in calculus if you think of slope as a _____.

The slope between two points will be referred to as _____.

Equations of a Line

The first equation of a line you used in algebra was probably the *slope – intercept form*: _____
The slope is _____, and the *y*-intercept is _____.

In calculus, it is actually easier to write the equation of a line in *point – slope form*: _____
The point is _____, and the slope is _____.

♫: To write an equation of a line, all you need is a _____ and the _____.

Another format used to write the equation of a line is called *standard (general) form*: _____
All variables are on the same side (usually in alphabetical order).

Example 2: Which of the equations above has "*y* written as a function of *x*" ?

Example 3: The point-slope form is written as _____ if you want "*y* written as a function of *x*"

Example 4: Find the equations of the lines passing through (–2, 4) and having the following characteristics:

a) Slope of $\frac{7}{16}$

b) Parallel to the line $5x - 3y = 3$

c) Passing through the origin

d) Parallel to the y – axis.

Example 5: Find the equations of the lines passing through (1, 3) and having the following characteristics:

a) Slope of $-\frac{2}{3}$

b) Perpendicular to the line $x + y = 0$

c) Passing through the point (2, 4)

d) Parallel to the x – axis.

Regression Analysis is a process of finding a curve to fit a set of data. The basic process involves plotting the points and finding a function that "best fits" those points. The curve you find is called the regression curve. For the purposes of this section, our "curve" is linear, but it could be a parabola or other power function, a logarithmic function, a trigonometric function, or an exponential function.

Example 6: The median price of existing single-family homes has increased consistently during the past few years. However, the data in the table below show that there have been differences in various parts of the country.

Year	1999	2000	2001	2002	2003
South ($)	145,900	148,00	155,400	163,400	168,100
West ($)	173,700	196,400	213,600	238,500	260,900

a) Find the linear regression equation for home cost in the South. _____

b) What does the slope of the regression line represent?

c) Find the linear regression equation for home cost in the West. _____

d) Where is the median price increasing more rapidly, in the South or the West? Explain.

e) Using your regression equation in part *c*, predict the cost of a home in the West in the year 2011.