

Math 131 Notes Section 1.2 Catalog of Functions.

Linear functions are of the form $f(x) = mx + b$. m is the slope and b is the y-intercept. The y-intercept is the y-value assigned to $x=0$ and is the y-value where the graph crosses the y-axis. If $m = 0$, the line is $f(x) = b$ and is a constant function, the graph is a horizontal line.

Any two points determine a line.

The slope, m , is the rise/run, that is $m = \frac{y_2 - y_1}{x_2 - x_1}$ for any two points on the line. The pt.-

slope form of the line is $y - y_1 = m(x - x_1)$. This is then simplified to the slope-intercept form.

Because m is constant and does not depend on which two points are used, the graph is a straight line.

$m = \frac{\text{rise}}{\text{run}}$, where the rise is the change in y and the run is the change in x.

If we know m and the change in x we can find the change in y.

rise = m (run) In other words, (change in y) = m (change in x).

Example: Given (2, 5) and (-1, 11) are on the line, find a) the slope intercept form.
b) the change in y corresponding to a decrease of 7 in x.

Solution: a) $m = \frac{11 - 5}{-1 - 2} = -2$ $y - 5 = -2(x - 2)$ $y - 5 = -2x + 4$ $y = -2x + 9$ is the slope int. form.

b) If x decreases by 7, the change in y is $-2(-7) = 14$ so y increases by 14.

Linear Regression in the Calculator: Please see the Linear Regression Instructions on my 131 webpage, (www.math.tamu.edu/~jlewis then Link to Math 131)

The linear regression line is the line which is closest to the data points according to a specific rule for closeness. The regression line is also called the least squares line or the best fit line. We will do problems from the link on my webpage, Regression Problems.

Polynomials: A polynomial is a sum of terms which are constants multiplied by non-negative whole powers of x.

Some examples of polynomials are: $f(x) = 4x^3 - 2x^2 + \frac{1}{3}x - 15$ $g(x) = -5x^4 + 2x$.

The highest power of x is called the **degree** of the polynomial. The term with the highest power of x is called the **leading term**. $f(x)$ has degree 3 and leading term $4x^3$. $g(x)$ has degree 4 and leading term $-5x^4$.

A *root* of a polynomial, $p(x)$, is an x-value r for which $p(r)=0$.

If the degree of a polynomial is 2, it is called a **quadratic**. A quadratic can have 0, 1 or 2 roots. To find the roots of the quadratic $ax^2 + bx + c$ solve the quadratic formula. The

roots are $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$. If the expression under the radical is negative, the quadratic

has no roots; if it is 0 the quadratic has one root; and if it is positive the quadratic has two roots.

A polynomial of degree 3 is a cubic; of degree 4 is a quartic.

A rational function is of the form $f(x) = \frac{p(x)}{q(x)}$ where p and q are polynomials.

A root function is of the form $f(x) = \sqrt[n]{x} = x^{1/n}$.

An algebraic function is a function which only involves addition, subtraction, multiplication, division and taking roots. For example

$$f(x) = \frac{(x^2 + 1)(x - 2)^{1/3}}{5x + 2} \quad \text{or} \quad g(x) = \sqrt{\frac{x^3 + 7}{x^2 - 4}}.$$

An exponential function is of the form $f(x) = a^x$ where a is a constant. Exponential functions behave very differently than power functions which have the form x^a .

Exponential functions will be explored in section 1.5.

Logarithmic functions will be explored in section 1.6.