

Lecture 1

Monday, January 3, 2022 9:33 PM

- * Prayer
- * Spiritual thought

General policies of the course :

- HW 25% (M problems for extra credit, up to 2%)
- Online (WebAssign) : 4%
- MT1 25%
- MT2 25%
- Final 25% - not comprehensive

* Show HW policies ...

* Access to WebAssign

where does Math 314 fit in Mathematics ?

Algebra

Geometry

Trigonometry

Calculus — $\left. \begin{array}{l} \text{Math 112} \\ \text{Math 113} \end{array} \right\}$ calculus of single variables.

Quantity x & y : x is independent, y depends on x .

Ex: $x = \text{time}$

$y = \text{a quantity depending on time}$

money in account
amount of salt in a container
temperature at one location
speed of motion
.....

However, in most cases, a quantity depends on more than one variable.

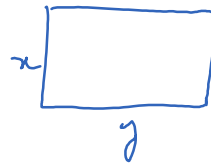
Ex temperature is a function of both time and space

position is a function of three variables: height, width, length

.....

One needs to consider functions of more than one variables.

Ex: $f(x,y) = 2(x+y)$ perimeter of a rectangle

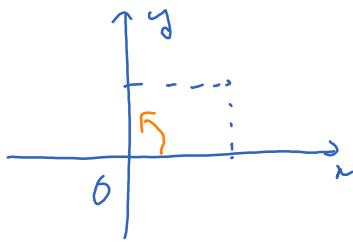


$f(x,y) = xy$ area of the rectangle.

$f(x,y) = \sqrt{x^2 + y^2}$ distance to the origin

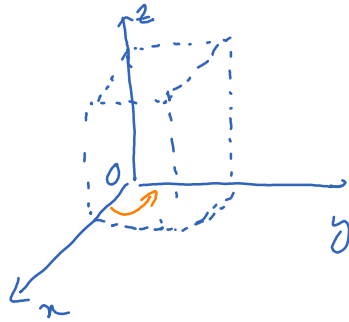
The coordinate system (Cartesian)

2D:



positively oriented

3D:



positively oriented, using the right hand rule.

A point is determined by a tripple (called coordinates)

$f(x)$	vs	$g(x,y)$
graph is a curve		graph is a surface
tangent line		tangent plane
derivative		partial derivatives
integral		double integral

Equation of a plane:

$$ax + by + cz + d = 0.$$

Distance:



$$OM = \sqrt{x^2 + y^2 + z^2}$$

Ex Intersection of 3 objects:

$$\text{plane 1: } x + y + z = 0 \quad (1)$$

$$\text{plane 2: } x - y + z = 2 \quad (2)$$

$$\text{sphere: } (x-2)^2 + (y-1)^2 + z^2 = 9 \quad (3)$$

Find the intersection:

$$\begin{aligned} (1) \rightarrow y + z = -x \\ (2) \rightarrow -y + z = 2 - x \end{aligned} \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} \begin{array}{l} z = 1 - x \\ y = -x - z = -x - (1 - x) = -1 \end{array}$$

$$(3) \rightarrow (x-2)^2 + (-1)^2 + (1-x)^2 = 9$$

$$\rightarrow (x-2)^2 + (x-1)^2 = 5 \quad \rightarrow 2x^2 - 6x + 5 = 5$$

$$\rightarrow x^2 - 3x = 0$$

$$\rightarrow x = 0 \text{ or } x = 3$$

