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1 Welcome to Calculus and its Applications!

- Course website: http://math120.straub.link

  The place for all materials: syllabus, lecture sketches, …

- MyLabsPlus: homework, quizzes and exams

  Username: J00XXXXXX

  Password: PASSWD

  After free trial, you need a **MyLabsPlus access code**.

- Book: MyLabsPlus provides electronic version

- Calculator: TI-30X

  Online graphing calculator: https://www.geogebra.org/graphing

1.1 Syllabus

TL;DR

- Homework (25% of your grade) on MyLabsPlus

  no pressure: unlimited attempts

  you need $\geqslant 70\%$ in order to take quizzes

  "Question Help" button offers hints, videos and worked examples

- Quizzes (10% of your grade) on MyLabsPlus

  you get two attempts to take each quiz; 50min time limit

- 3 tests (15% each) and final exam (20% of your grade)

  taken in class (in computer lab)

  practice tests: if $\geqslant 90\%$, then $+3\%$ on exam

- Bonus for good attendance

  $\leqslant 4$ unexcused absences: final exam replaces lowest test score

- Do you want or need MA125?

  Or any other class of the calculus sequence?

  If yes, then **this class is not for you**!

Let's recall some of the common kinds of functions.

- Polynomials:

  - linear functions: $f(x) = 2x - 3$

  - quadratic functions:
    $f(x) = x^2 + 2x - 3 = (x-1)(x+3)$
    [Review factoring and solving quadratic equations.]

  - cubic functions:
    $f(x) = 2x^3 - 3x^2 + x + 1$

  - higher degree:
    $f(x) = x^{17} - x^5 + 1$
    (this is a degree 17 polynomial)

Doing the Pre Calculus Dance

by chibipandora @ deviantART

HW. Cute as they are… a few ghosts need to seriously work on their moves!! Which?

- Rational functions:

  These are just quotients of polynomials.

  - $f(x) = \frac{x+1}{x-1}$

  - $f(x) = \frac{x^2 + 3x + 1}{x^3 + 1}$

- Algebraic functions:

  - square root: $f(x) = \sqrt{x} = x^{1/2}$

    For experts. Algebraic functions are those that appear when solving polynomial equations. For instance, $x^2 - 5 = 0$ has the solution $x = \sqrt{5}$.

- Exponential functions:

  - $f(x) = 2^x$ (2 is called the **base**)

  - $f(x) = e^x$ (with the natural base $e \approx 2.718$)

    We'll learn what makes this one of the most important functions.

- Logarithms:

  - $f(x) = \ln(x)$

- Trigonometric functions: (we will not discuss these)

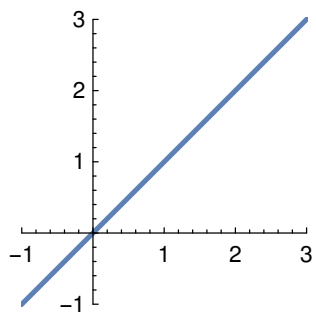 - $f(x) = \cos(x)$, $f(x) = \tan(x)$, ...

Play time! Plot several of these using GeoGebra

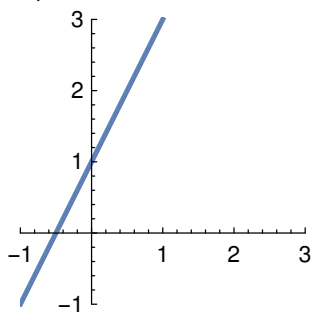https://www.geogebra.org/graphing

1.3 Review: Lines and slope

$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x} \quad \left(\text{i.e. } \frac{\text{change in } y}{\text{change in } x}\right)$$
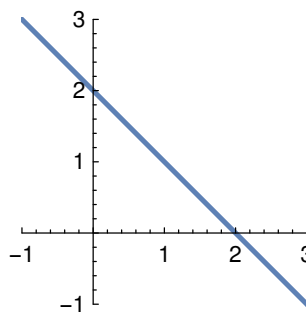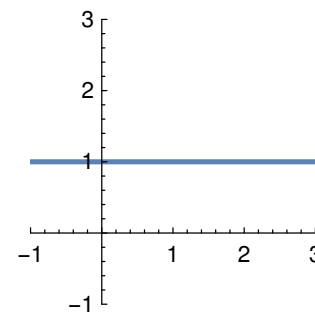
Just by looking, estimate/read off the slope of each line.

$\text{slope} = 1$ $\text{slope} = 2$ $\text{slope} = -1$ $\text{slope} = 0$

What are the y-intercepts?

$(0,0)$ $(0,1)$ $(0,2)$ $(0,1)$

Using these values, what is the equation for the line?

$y = x$ $y = 2x + 1$ $y = -x + 2$ $y = 1$

(slope-intercept form of a line)

$y = mx + b$ describes a line with slope m and y-intercept $(0, b)$.

Example 1. Determine the intercepts of $y = 2x + 1$.

Solution. The y-intercept is $(0, 1)$.

To find the x-intercept, we set $y = 0$ and solve: $0 = 2x + 1$

Hence, $x = -\frac{1}{2}$. The x-intercept is $\left(-\frac{1}{2}, 0\right)$.

(Point-slope form of a line)

$y - y_0 = m(x - x_0)$ describes a line with slope m through the point (x_0, y_0).

Example 2. Find an equation for the line with slope $m = 3$ containing the point $(2, -1)$.

Solution. $y + 1 = 3(x - 2)$

1.4 Tangent lines

> *tangere [latin] — to touch*
>
> On a curious tangential note, the origin of the word tango (the dance) is disputed (though the Latin meaning is fitting).

The fundamental insight of calculus is that (essentially) every function can be (locally) approximated with linear functions.

Play time! GeoGebra demo

Checklist.

- bookmark course website
- sign into MyLabsPlus; immediately complete:
  - "About this course"
  - "Orientation to MyLabsPlus"
- graph some functions in GeoGebra
- do "Chapter 0 & Section 1.1: Some review" assignment (24 questions)
- check out Sections 1.1 and 1.2 in the book

(Book available in MyLabsPlus under "eText".)