Pre-Calc AB

Lesson 41

10/19/15

Agenda: 10/19/15

HW Leader:

Lesson 41

Reciprocal Trig functions

Permutation Notation

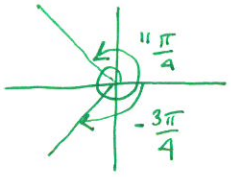
- Test 5 lessons 1-39
- Handout Study Guide

Definition:

$$\frac{1}{\cos\theta} = \sec\theta = \frac{hyp}{adj} \qquad \frac{1}{\sin\theta} = \csc\theta = \frac{hyp}{opp} \qquad \frac{1}{\tan\theta} = \cot\theta = \frac{adj}{opp}$$

Ex. 41.2 Evaluate: $\frac{2}{3}\csc\left(-\frac{3\pi}{4}\right) - \sec\left(\frac{11\pi}{4}\right)$

$$= \frac{2}{3}\cdot\frac{1}{\sin\left(-\frac{3\pi}{4}\right)} - \frac{1}{\cos\left(\frac{11\pi}{4}\right)}$$

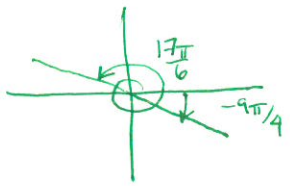


$$= -\frac{2}{3}\cdot\frac{1}{\sin(\pi/4)} + \frac{1}{\cos(\pi/4)}$$

$$= -\frac{2}{3}\left(\sqrt{2}\right) + \sqrt{2} = \boxed{\frac{\sqrt{2}}{3}}$$

Ex. 41.4 Evaluate: $\cot\left(\frac{17\pi}{6}\right) - \sqrt{6}\csc\left(-\frac{9\pi}{4}\right)$

$$= \frac{\cos\left(\frac{17\pi}{6}\right)}{\sin\left(\frac{17\pi}{6}\right)} - \sqrt{6}\cdot\frac{1}{\sin\left(-\frac{9\pi}{4}\right)}$$



$$= \frac{-\cos(\pi/6)}{\sin(\pi/6)} + \sqrt{6}\cdot\frac{1}{\sin(\pi/4)}$$

$$= \frac{-\sqrt{3}/2}{1/2} + \sqrt{6}\left(\sqrt{2}\right) = -\sqrt{3} + 2\sqrt{3} = \boxed{\sqrt{3}}$$

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Ex 41.5 How many permutations are there of 22 things taken 6 at a time? Generalize this for n things taken r at a time.

n	n-1	n-2	n-3	n-4	n-5
22	21	20	19	18	17

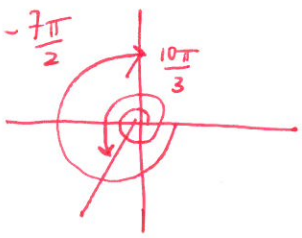
Permutations are $22 \cdot 21 \cdot 20 \cdot 19 \cdot 18 \cdot 17 = 53,721,360$

$$n \cdot (n-1) \cdot (n-2) \cdots (n-r+1) = {}_nP_r \text{ or } P(n,r)$$

$${}_nP_r = \frac{n \cdot (n-1)(n-2) \cdots (n-r+1) \cdot (n-r) \cdots 3 \cdot 2 \cdot 1}{(n-r) \cdots 3 \cdot 2 \cdot 1} = \frac{n!}{(n-r)!}$$

Ex. Compute ${}_{10}P_3 = \frac{10!}{(10-3)!} = \frac{10!}{7!} = 10 \cdot 9 \cdot 8 = 720$

Your Turn Evaluate: $\csc\left(\frac{10\pi}{3}\right) + \sec(-7\pi)$



$$= \frac{1}{\sin\left(\frac{10\pi}{3}\right)} + \frac{1}{\cos(-7\pi)}$$

$$= -\frac{1}{\sin(\pi/3)} + \frac{1}{\cos(\pi)}$$

$$= -\frac{1}{\sqrt{3}/2} + (-1)$$

$$= -\frac{2\sqrt{3}}{3} - 1 = \frac{-2\sqrt{3}-3}{3}$$

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Lesson 42

Conic Sections

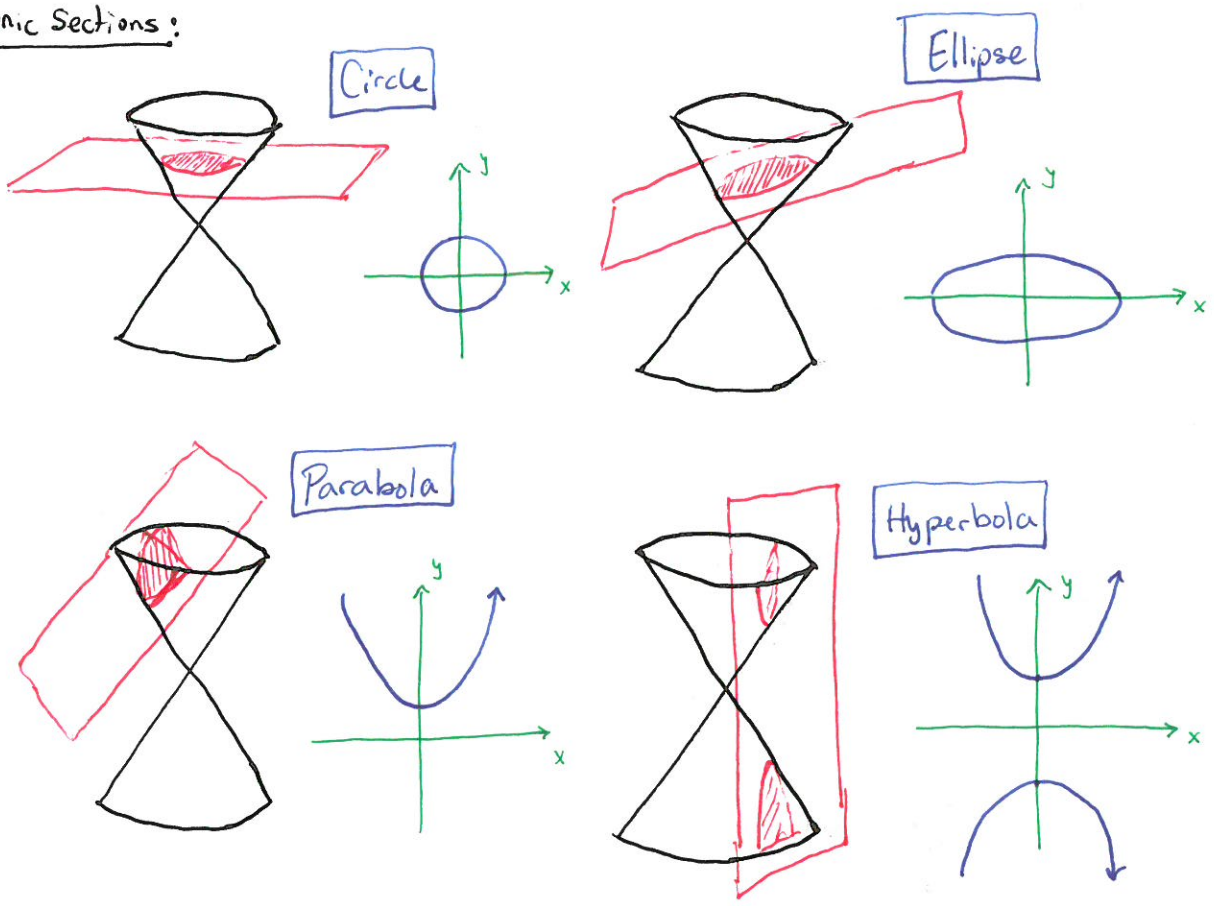
Circles

Constants in Exp. functions

★ Test 5 tomorrow

• Handout WS 13

Conic Sections:



Circles:

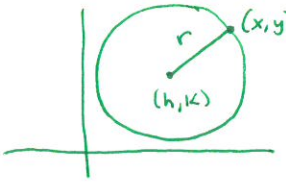
Definition - a circle is the locus of all points in a plane that are equidistant from a point called the center of the circle.

Circle centered at the origin with radius r:

$x^2 + y^2 = r^2$ Standard Form

$x^2 + y^2 - r^2 = 0$ General Form

Circle centered at (h,k) with radius r:



$r = \sqrt{(x-h)^2 + (y-k)^2}$

$(x-h)^2 + (y-k)^2 = r^2$ Standard Form

$x^2 - 2xh + h^2 + y^2 - 2yk + k^2 - r^2 = 0$ General Form

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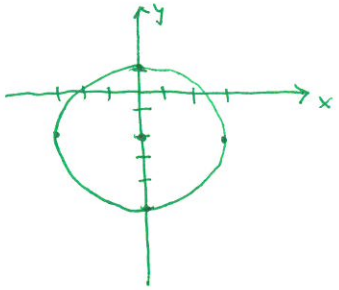
Ex. Find the standard form of the equation of a circle centered at $(0,-2)$ with radius 3. Then write the general form.

$(x-0)^2 + (y+2)^2 = 3^2$ Standard Form



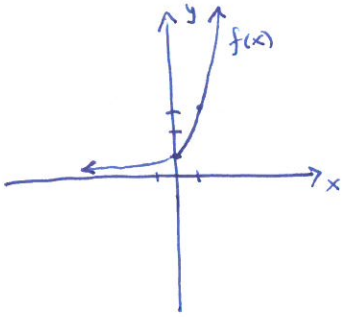
$x^2 + y^2 + 4y - 5 = 0$ General Form

Constants in Exponential Functions:

Sketch the functions:

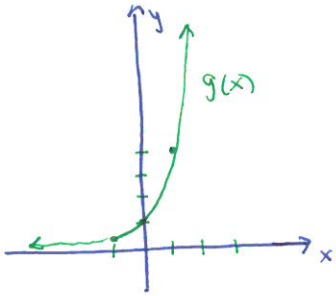
$f(x) = \left(\frac{1}{3}\right)^{-x} = \left(\left(\frac{1}{3}\right)^{-1}\right)^{x} = 3^x$

1. reflect about y-axis



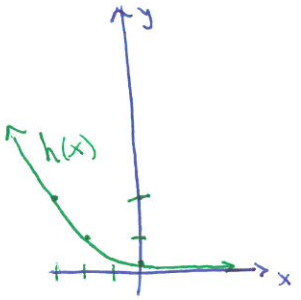
$g(x) = 2^{2x} = (2^2)^x = 4^x$

1. horizontal shrink by 2



$h(x) = 2^{-x-2} = 2^{-x} \cdot 2^{-2} = \frac{1}{4} \cdot \left(\frac{1}{2}\right)^x$

1. reflect about y-axis
2. shift 2 units left



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HW Leader:

Lesson 43

Periodic Functions

Graphs of cos and sin

★ Test 5 back after lesson

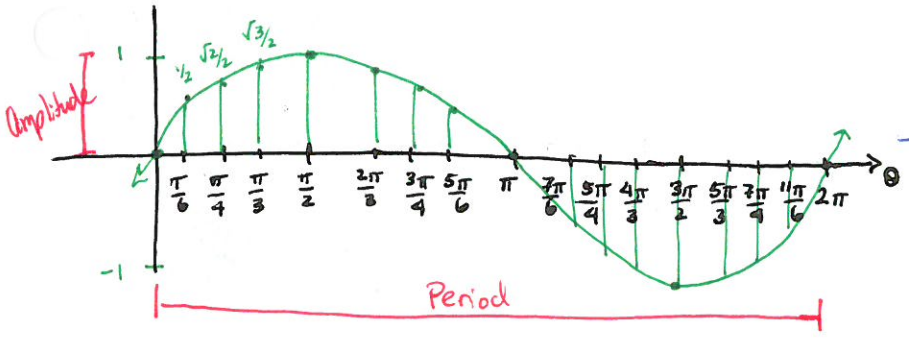
• Handout WS 14

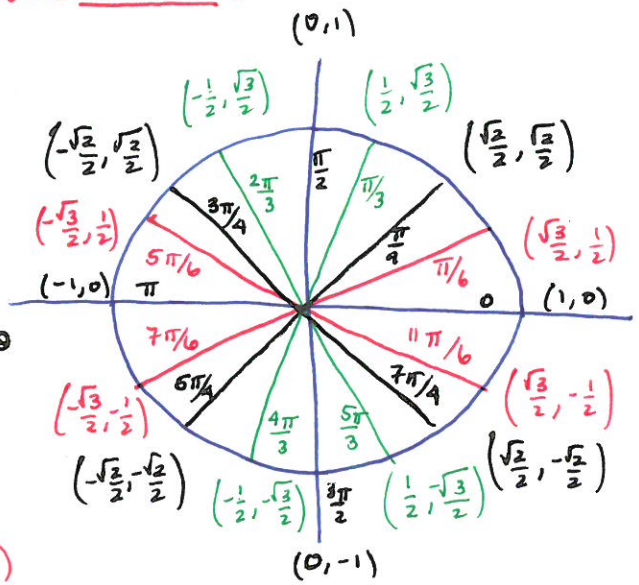
The graph of a periodic function has a repeating pattern. [★ Important in the study of Vibrating motion]

★ Most important periodic functions are sine and cosine.

A curve that looks like a sine curve is called a Sinusoid.

Graph of $f(\theta) = \sin(\theta)$:

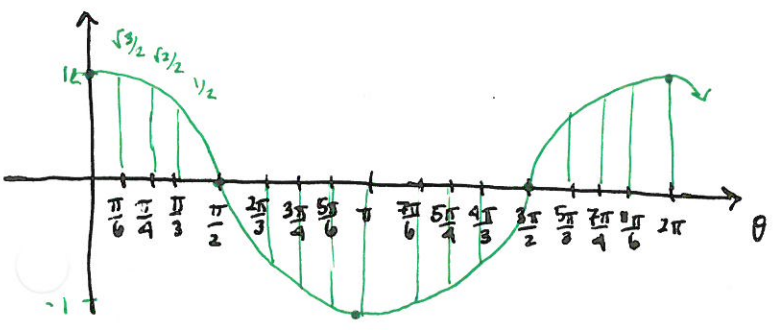




Amplitude = 1 (middle to top or middle to bottom)

Period = 2π or $360°$ (one time around the unit circle)

Graph of $f(\theta) = \cos(\theta)$:



• Same as the graph of sine but shifted horizontally $\pi/2$ to the left.

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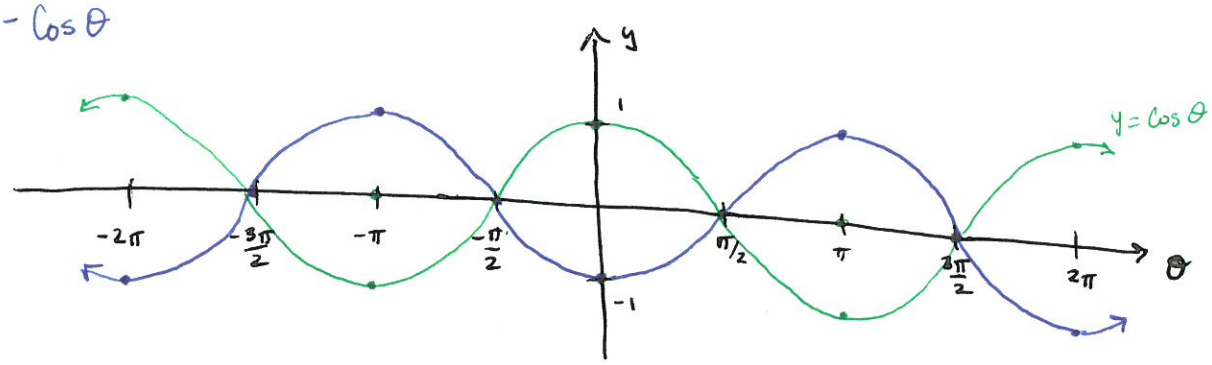
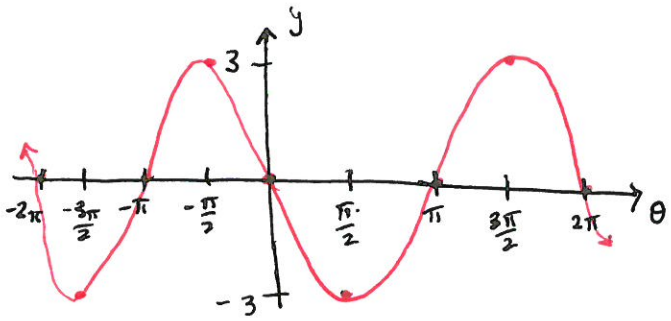
$y = -\cos\theta$

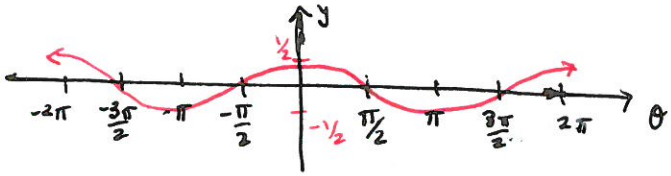


Ex. Sketch

$f(\theta) = -3\sin\theta$



$g(\theta) = \frac{1}{2}\cos\theta$



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HW Leader:

Lesson 44

Abstract Rate Problems

Ex. 44.1 Peter purchased p pencils for d dollars. If the p pencils had cost x more dollars, how many pencils could Peter have purchased for $20?

Pencils	Cost per pencil (rate)	total
p pencil	$\frac{d+x}{p}$ \$/pencil	$d+x$ \$
y	$\frac{d+x}{p}$	20

$$y = \frac{20p}{d+x} \text{ pencils}$$

Ex 44.3 On an assembly line m workers worked n hours to produce C articles. If d workers quit, how long would it take the remaing workers to produce the same number of articles.

workers	time	rate per worker	jobs
m	h	$\frac{C}{mh}$	C
$m-d$	X	$\frac{C}{mn}$	C

$$X = \frac{\cancel{C}}{m-d} \cdot \frac{mn}{\cancel{C}} = \frac{mn}{m-d} \text{ hours}$$

Your Turn Start #1, 2, 3

1. $\frac{100d}{x-5}$ drums

$\frac{Wh}{w+m}$ hours

3. $P \cdot \frac{Cm}{P} \cdot \frac{1}{c+n} = \frac{Cm}{c+n}$ minutes

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Agenda: 10/26/15

HW leader:

Lesson 45

Conditional Permutations

Two variable analysis

★ Quiz 6 on Wednesday Lessons 38-44 · radians · Laws of logs · reciprocal Trig · FCP · circles · exp. graphs, sin & cos · overall average rate · A bstract rate

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- Permutations - arrangements in a definite order ★ Can have conditions attached

Ex. Find the number of odd 3-digit numbers (counting) that are less than 400.

- Statement indicates repetition is permissible.
- 1st digit 1, 2, 3 (0 would mean two digits)
- 2nd digit any 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
- 3rd digit 1, 3, 5, 7, or 9 only

3	10	5

$3 \cdot 10 \cdot 5 = 150$

There are 150 odd 3-digit numbers less than 400.

Ex 45.3 5 math books and 4 English books are on a shelf. How many permutations are possible if the math books must be kept together and the English books must be kept together?

- Are repetitions allowed? No
- Options: first Math then English, or English then Math

1.

5	4	3	2	1	4	3	2	1

MATH English

$5! \times 4! = 2880$

2. Switch MATH and English still the same # of permutations $4! \times 5! = 2880$

There are 5760 possible permutations.

Ex. A photographer wants to know how many possible arrangements are there of a bridal party of 8 if the bride and groom must always be next to each other.

- Repetitions? No
- Arrange the 6 others and the 1 bride/groom first
- Then how many ways to arrange the bride and groom.

7!	6	5	4	3	2	1

7!

2!

$7! \times 2! = 10080$

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Two Variable Analysis Using a Graphing Calculator

- Open book to page 321
  - Black line modeling the relationship to Silver and gold We already know how to estimate
- The process of estimating the equation of a line that best fits the data is called linear regression.
- Your graphing calc uses the least squares algorithm for this

1. Entering the data: STAT → 1:EDIT → L1 (enter input), L2 (enter output)
2. Linear Regression: STAT → CALC → 4:LinReg(ax+b) → ENTER

[if missing r^2; r → 2nd → 0 → DiagnosticOn → ENTER retry]

(2nd → 0: Catalog)

★ r is called the Correlation Coefficient: tells you how well the line models the data

- +1 means all points on line, slope is postive
- -1 means all points on line, slope is negative
- 0 means points so scattered, doesn't determine a line.

LinReg
y=ax+b
a=-.2075
b=25.64
r=-.7824726541

- Scientific Data $+1 \geq r \geq 0.9$ or $-0.9 \geq r \geq -1$
- Social Science $+1 \geq r \geq 0.7$ or $-0.7 \geq r \geq -1$