MY

MATH III

FORMULA

BOOK

THIS BOOK BELONGS TO:

THE ANSWER FAIRY

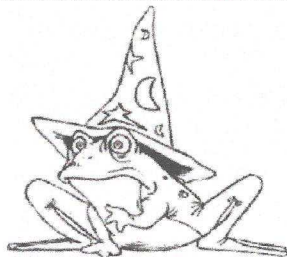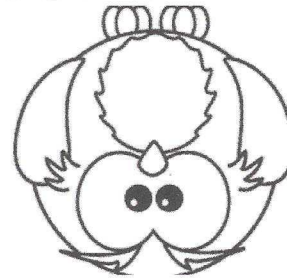# FUNCTION FAMILIES

$$f(x) = a\,f(x-h) + k$$

DOMAIN	RANGE
look at x	look at y
TRANSFORMATIONS	
Flip	Stretch/Compression
negative a	a>1 stretch 0<a<1 compression
Horizontal h "with" x, opposite direction	Vertical k "outside" x same direction

INVERSE FUNCTIONS

How to find an inverse function
Switch x & y then solve for y for logs & exponential functions, switch form

QUADRATIC FUNCTIONS

Standard Form: $f(x) = ax^2 + bx + c$

Find vertex by completing the square
move c to other side   add $\left(\frac{b}{2}\right)^2$ to both sides then factor perfect square
Or short cut
Vertex $\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$

Vertex Form: $f(x) = a(x-h)^2 + k$

Vertex:	Opens up if:
(h, k)	a is positive

SOLVE QUADRATICS BY...

Always put in standard form first

Factoring
find factors of a times c   that add UP to b...   remember to "swing" if $a \neq 1$
Quadratic Formula
$\dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Graphing
2nd trace zero   to find where graph crosses X axis

FOCUS → DIRECTRIX
point ↵   ↳ line

remember $a = \frac{1}{4P}$

P is distance from vertex to focus & vertex to directrix

POLYNOMIAL FUNCTIONS

$$f(x) = a_n x^n + a_{n-1} x^{n-1} + \cdots + a_0 x^0$$

Pascal's Triangle	
	1
	1 2 1
	1 3 3 1
	1 4 6 4 1
	1 5 10 10 5 1 etc

will have
n+1 terms

Binomial Expansion

$$(a+b)^n = P_0 a^n b^0 + P_1 a^{n-1} b^1 + P_2 a^{n-2} b^2 + \ldots$$
$$P_{n-1} a^1 b^{n-1} + P_n a^0 b^n$$

Complex Numbers

$i = \sqrt{-1}$

$i^2 = -1$

format of complex #

$a + bi$

Steps to find all roots

① graph on calculator & identify real roots

② use synthetic division to factor out real roots

③ use quadratic formula to find complex roots
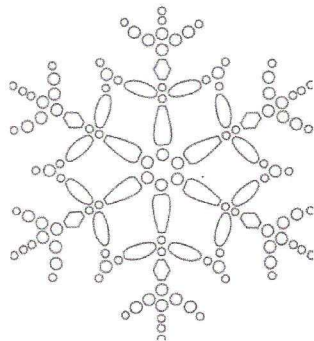
special cases
  diff of squares $(a^2 - b^2) = (a+b)(a-b)$
  sum and difference of cubes
  $(a^3 + b^3) = (a+b)(a^2 - ab + b^2)$
  $(a^3 - b^3) = (a-b)(a^2 + ab + b^2)$

End behavior
  if n is odd, opposite directions
  if n is positive, same directions

RATIONAL FUNCTIONS

$$f(x) = \frac{p(x)}{q(x)}$$

HOW TO FIND...

fully factor numerator + denominator

Holes
caused by factors that cancel out of the numerator + denominator
Vertical Asymptotes $x = ...$
caused by values of x that cause the simplified denominator to $= 0$
Horizontal Asymptotes $y = ...$
compare degree of numerator and denominator
$n > d$ no HA
$n = d$ divide leading coefficient of numerator by
$n < d$ HA at line $y = 0$
x intercepts
set numerator $= 0$ & solve
y intercepts
evaluate function at $x = 0$

leading coef. of denominator

EXPONENTIAL FUNCTIONS

$$f(x) = a(b)^{x-h} + k$$

Properties of Exponents	$x^0 = 1 \quad x^{1/2} = \sqrt{x} \quad x^{\frac{m}{n}} = \sqrt[n]{x^m} \quad x^{-n} = \frac{1}{x^n}$ $x^n x^m = x^{n+m} \quad \frac{x^n}{x^m} = x^{n-m} \quad (x^n)^m = x^{n \cdot m}$
Simple Growth and Decay Formula	$A = P(1 \pm r)^t$
Periodic Compounding Formula	$A = P\left(1 + \frac{r}{n}\right)^{nt}$
Continuous Compounding Formula	$A = Pe^{rt}$

P = what you start with

r = interest rate in decimal form

t = time in years

n = # interest payments in 1 year

LOGARITHMIC FUNCTIONS

$$f(x) = a \log_b(x - h) + k$$

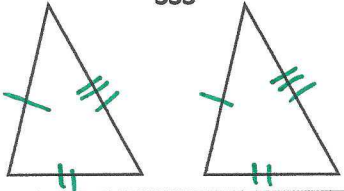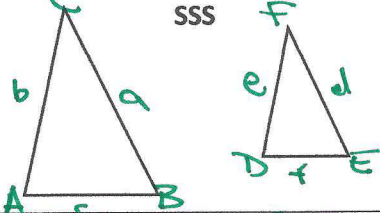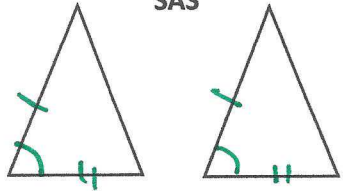| |
|---|
| **THE Relationship between Logarithms and Exponential Functions** $b^x = y \quad \Leftrightarrow \quad \log_b y = x$ |
| **Properties of Logarithms** $\log(m \cdot n) = \log m + \log n$ $\log\left(\frac{m}{n}\right) = \log m - \log n$ $\log m^n = n \log m$ |
| **Change of Base Formula** $\log_b m = \dfrac{\log m}{\log b}$ |

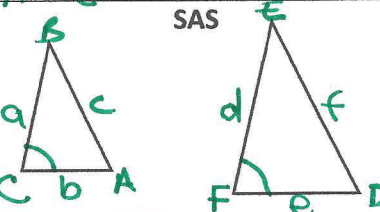# STATISTICS

NORMAL CURVE PERCENTAGES

Normal curve with values: 0.15, 2.35, 13.5, 34, 34, 13.5, 2.35, 0.15 across z-values -3, -2, -1, 0, 1, 2, 3
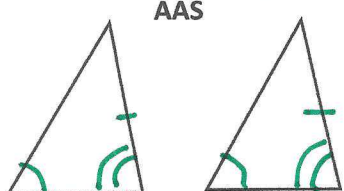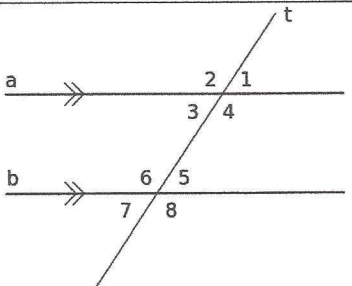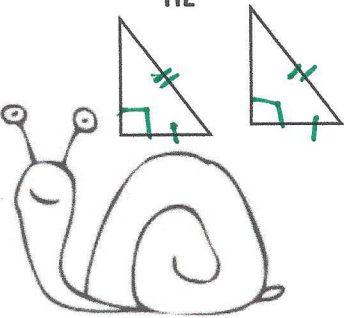
68%
95%
99.7%
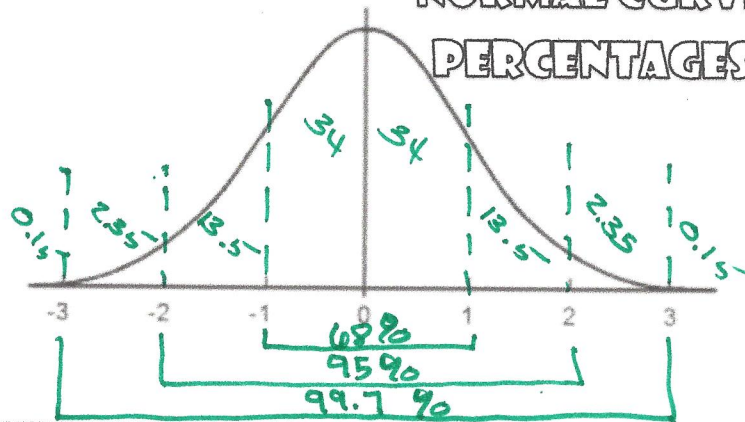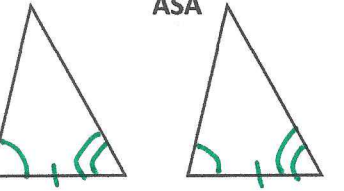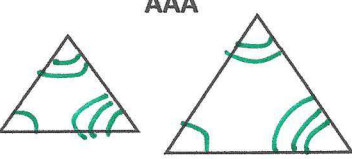
Mean	written as $\bar{X}$ or μ, average
Standard Deviation	$\sigma = \sqrt{\dfrac{\Sigma(x-\bar{x})}{n}}$ note square root of variance = standard deviation
z-Score	$z = \dfrac{x-\bar{x}}{\sigma}$

SEQUENCES AND SERIES

	ARITHMETIC	GEOMETRIC
Series	$\sum\limits_{n=1}^{K} u_n = \dfrac{K}{2}(u_1+u_k)$	$\sum\limits_{n=1}^{K} u_n = u_1\left(\dfrac{1-r^K}{1-r}\right)$
Sequence	$u_n = u_1+(n-1)d$	$u_n = u_1 r^{n-1}$

GEOMETRY

CONGRUENT TRIANGLES	SIMILAR TRIANGLES
SSS	**SSS**
	$\frac{b}{e} = \frac{a}{d} = \frac{c}{f}$
SAS	**SAS**
	$\angle c \cong \angle f$ $\frac{a}{d} = \frac{b}{e}$
ASA	**AAA**
AAS	**Parallel Line Properties**
HL	

Congruent Angles Pairs:

Vertical
corresponding
Alt interior
Alt exterior
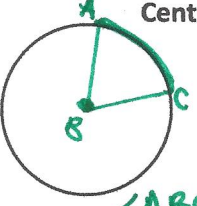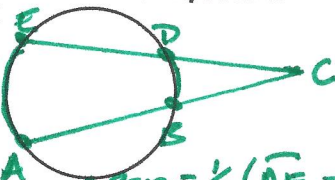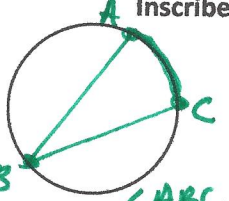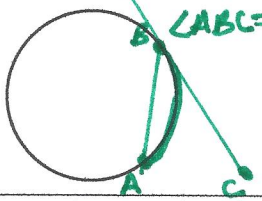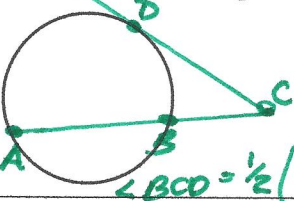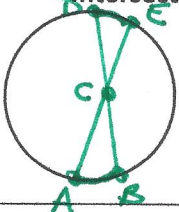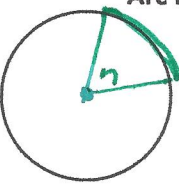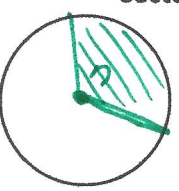
GEOMETRY

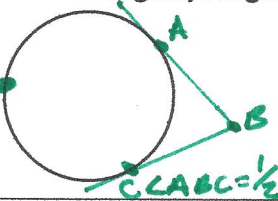| INTERIOR ANGLES	EXTERIOR ANGLES
Central $\angle ABC = \overset{\frown}{AC}$	**Secant/Secant** $\angle BCD = \frac{1}{2}(\overset{\frown}{AE} - \overset{\frown}{BD})$
Inscribed $\angle ABC = \frac{1}{2}\overset{\frown}{AC}$	**Tangent/Tangent** $\angle ABC = \frac{1}{2}(\overset{\frown}{ADC} - \overset{\frown}{AC})$
Tangent/Chord $\angle ABC = \frac{1}{2}\overset{\frown}{AB}$	**Secant/Tangent** $\angle BCD = \frac{1}{2}(\overset{\frown}{AD} - \overset{\frown}{BD})$
Intersecting Chords	**Arc Length** $\frac{n}{360} 2\pi r$
	Sector Area $\frac{n}{360} \pi r^2$

$\angle ACB = \frac{1}{2}(\overset{\frown}{AB} + \overset{\frown}{DE})$

SEGMENT LENGTHS
$\overline{DC} \cdot \overline{CB} = \overline{EC} \cdot \overline{CA}$

SEGMENT LENGTHS
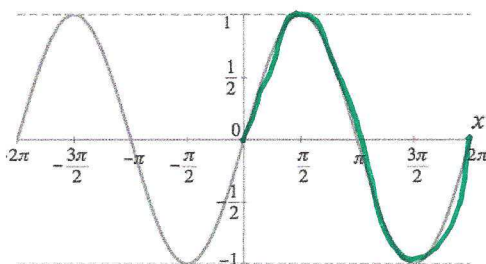$\overline{ED} \cdot \overline{DC} = \overline{AB} \cdot \overline{BC}$

$\overline{DC}^2 = \overline{AB} \cdot \overline{BC}$
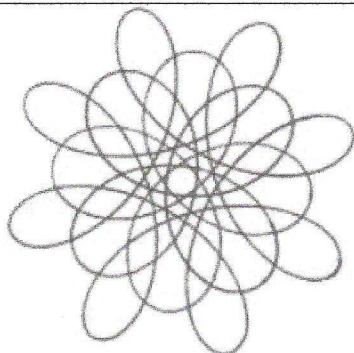
TRIGONOMETRY

$$f(x) = a \sin b(x - h) + k$$

$$f(x) = a \cos b(x - h) + k$$
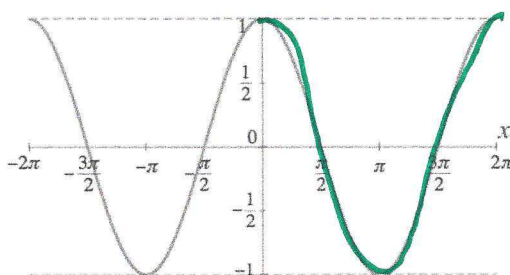
Amplitude: a	Period: $\dfrac{2\pi}{b}$
Phase Shift: h	Mid Line: $y = K$

IDENTITIES

Basic Identities

$$\sin = \frac{o}{h} = y \qquad \cos = \frac{a}{h} = x \qquad \tan = \frac{o}{a} = \frac{y}{x} = \frac{\sin}{\cos}$$

$$\csc = \frac{1}{\sin} \qquad \sec = \frac{1}{\cos} \qquad \cot = \frac{1}{\tan} = \frac{x}{y} = \frac{\cos}{\sin}$$

Pythagorean Identities

$$\sin^2 + \cos^2 = 1 \qquad \tan^2 + 1 = \sec^2 \qquad 1 + \cot^2 = \csc^2$$

TRIGONOMETRY

UNIT CIRCLE, FIRST QUADRANT

Unit circle first quadrant diagram with handwritten green annotations:
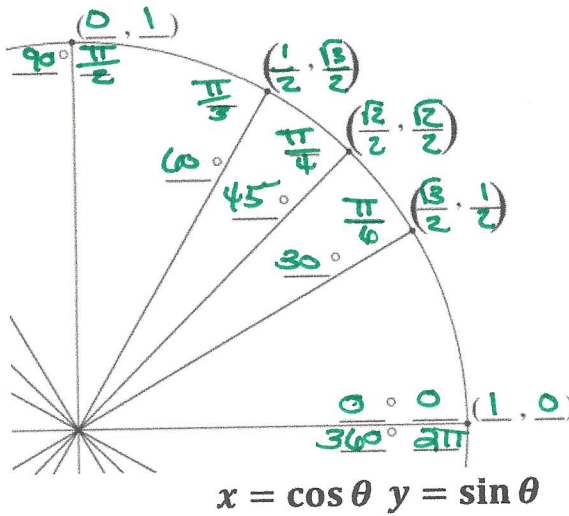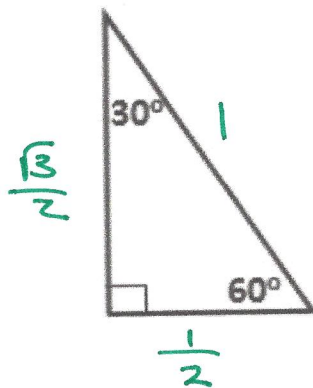
- $(0, 1)$ at top, $90°$, $\frac{\pi}{2}$
- $\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$ at $60°$, $\frac{\pi}{3}$
- $\left(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right)$ at $45°$, $\frac{\pi}{4}$
- $\left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$ at $30°$, $\frac{\pi}{6}$
- $(1, 0)$ at $0°$, $360°$, 2π

$$x = \cos\theta \quad y = \sin\theta$$

Convert Degrees to Radians: **multiply by** $\frac{\pi}{180}$

Convert Radians to Degrees: **multiply by** $\frac{180}{\pi}$

SPECIAL RIGHT TRIANGLES

30-60-90 Triangle

Triangle with angles $30°$ (top) and $60°$ (bottom right), right angle at bottom left. Hypotenuse $= 1$, vertical side $= \frac{\sqrt{3}}{2}$, horizontal side $= \frac{1}{2}$.

45-45-90 Triangle

Triangle with angles $45°$ (top) and $45°$ (bottom left), right angle at bottom right. Hypotenuse $= 1$, vertical side $= \frac{\sqrt{2}}{2}$, horizontal side $= \frac{\sqrt{2}}{2}$.
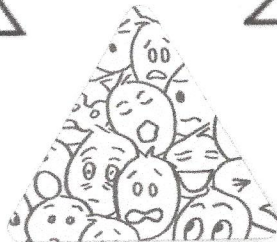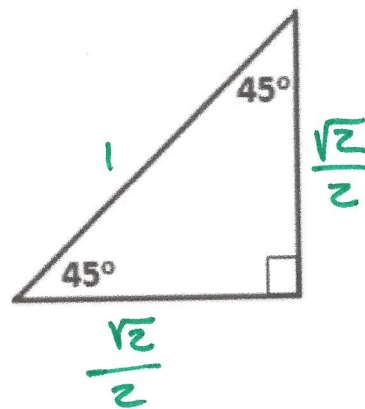
CALCULATOR
TIPS
HOW DO YOU...

Clear Memory	2nd + 7 1 2
Convert Decimal Values To Fraction	MATH 1 ENTER
Find Max and Min	2nd TRACE 4 or 2nd TRACE 3
Find x intercepts	2nd TRACE 2
Find y intercepts	FIND X=0 IN TABLE 2nd GRAPH
Reset graph viewing window	ZOOM 6 STANDARD
Find appropriate viewing window	WINDOW THEN SET X & Y / MIN, MAX & SCL
Find Standard Deviation	① STAT EDIT → ENTER DATA use σx ② STAT CALC 1 VAR STATS
Create quadratic and cubic models	① STAT EDIT → ENTER DATA ② STAT CALC → select regression
Find intersection of two functions	2nd TRACE 5
Change Log Base	MATH A (not on all calcs)
Calculate Summations	MATH 0 (not on all calcs)
Other Area under normal curve	2nd VARS 2 normalcdf
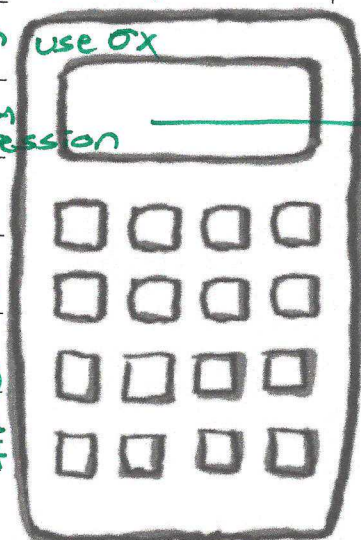
don't forget to use VARS TO put equation in Y_1

lower
upper
μ
σ

remember
infinity is ±1E99