

MTH 103 SEMESTER EXAM GUIDE

Lessons 1.1 to 1.7, 2.1 to 2.3, 2.5, 3.1 to 3.7, 4.1 to 4.6, 5.1, & 5.3

FORMULAS YOU SHOULD STUDY:

Quadratic formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Slope formula: $m = \frac{y_2 - y_1}{x_2 - x_1}$

Slope-intercept form of a line: $y = mx + b$

Point-slope form of a line: $y - y_1 = m(x - x_1)$

Direct Variation: $y = kx$ (k is called the **constant of variation** or **constant of proportion.**)

Indirect Variation: $y = k\left(\frac{1}{x}\right)$ or $y = \frac{k}{x}$ **y varies inversely with x or y is inversely proportional to x**

Joint Variation: $y = kxz$ **y varies jointly as x and z**

Vertex of a parabola: $\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$

Compound Interest: $A = P\left(1 + \frac{r}{n}\right)^{nt}$

Continuous Interest: $A = Pe^{rt}$

Exponential Growth/Decay Model: $A = A_0e^{kt}$

Definition of Logarithm: $\log_b x = y$ means $b^y = x$ ($b > 0$, $b \neq 1$)

Special Log Properties:

$$\log_b 1 = 0$$

$$\log_b b = 1$$

$$\log_b b^m = m$$

$$b^{\log_b m} = m$$

Product Rule: $\log_b MN = \log_b M + \log_b N$

Quotient Rule: $\log_b M/N = \log_b M - \log_b N$

Power Rule: $\log_b M^p = p \log_b M$

Change of Base Rule: $\log_b M = \log_a M / \log_a b$

One-to-One Properties: If $b^M = b^N$ then $M = N$.

If $\log_b M = \log_b N$ then $M = N$.

If $M = N$ then $\log_b M = \log_b N$.

Expressing an Exponential Model in Base e :

$$y = ab^x \text{ is equivalent to } y = ae^{(\ln b)x} \text{ or } y = ae^{x \ln b}$$

SYMBOLS YOU SHOULD KNOW THE MEANING OF:

 f^{-1} $f \circ g$

interval notation such as $(0, \infty)$ and $[-2, 9)$

 $(f+g)(x)$ $(f-g)(x)$ $(f \bullet g)(x)$ $(f/g)(x)$

VOCABULARY:

Asymptote

Coefficient

Complex number

Degree

Direct Variation

Domain

End behavior

Increasing/decreasing

Indirect Variation

Intercepts (x and y)

Leading coefficient

Maximum/minimum (optimization)

Multiplicity

Parabola

Perpendicular

Polynomial

Quadratic equation

Range

Turning point

Vertex

Zero

ALGORITHMS/PROCESSES:

Calculate the distance between two points on a graph

Do and understand the results of long division

Do and understand the results of synthetic division

Do operations with complex numbers

Evaluate functions and their inverses using equations and graphs

Evaluate the composition of a function using equations and graphs

Evaluating piece-wise functions

Factor

Find the domain and range and asymptotes of functions from equations and graphs

Find the equation of a line from given information

Find the equation/graph of the inverse of a function

Find the minimum/maximum points on a graph

Find the slope of a line, a line parallel to a given line, a line perpendicular to a given line

Find the vertex of a parabola

Find x- and y-intercepts

Find zeros and their multiplicities

Identify intervals of increase and decrease on a graph

Know and apply log rules

Set up and solve direct variation problems

Set up and solve indirect variation problems

Simplify expressions containing logs and exponents

Solve absolute value equations & inequalities

Solve equations containing radicals

Solve exponential equations

Solve linear equations and inequalities

Solve literal equations

Solve logarithmic equations

Solve polynomial and rational inequalities using boundary points (test points)

Solve problems involving projectile motion

Solve quadratic equations using factoring, square root property, and quadratic formula

Solve rational equations

Solve story problems involving maximums/minimums

Transform graphs using HSRV

Use change-of-base formula to evaluate logs

Use completing the square to solve problems

Use the exponential/growth decay model to solve problems