Math 115 Reference Sheet

Exponential Expressions

$$(ab)^n = a^n b^n \qquad \left(\frac{a}{b}\right)^n = \frac{a^n}{b^n} \qquad (b^m)^n = b^{mn}$$

$$b^m b^n = b^{m+n} \qquad \frac{b^m}{b^n} = b^{m-n} \qquad b^{-n} = \frac{1}{b^n} \qquad \frac{1}{b^{-n}} = b^n$$

$$a^{\frac{m}{n}} = \left(\sqrt[n]{a^m}\right) \qquad a^{\frac{m}{n}} = \left(\sqrt[n]{a}\right)^m \qquad a^{-\frac{m}{n}} = \frac{1}{a^{\frac{m}{n}}} \qquad a^{\frac{1}{n}} = \sqrt[n]{a}$$

Special Factorizations

$$A^2 - B^2 = (A+B)(A-B)$$

$$A^2 + 2AB + B^2 = (A+B)^2 \qquad A^2 - 2AB + B^2 = (A-B)^2$$

$$A^3 + B^3 = (A+B)(A^2 - AB + B^2) \qquad A^3 - B^3 = (A-B)(A^2 + AB + B^2)$$

Linear Functions and Slope

Slope: $m = \frac{y_2 - y_1}{x_2 - x_1}$ **Point − Slope Form:** $y - y_1 = m(x - x_1)$

Slope − Intercept Form: $y = mx + b$ **General Form:** $Ax + By + C = 0$

Quadratic Equations and Functions

If $ax^2 + bx + c = 0$ **then** $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Standard form of a parabola: $f(x) = a\,(x-h)^2 + k$, $a \neq 0$; **The vertex is** (h, k)

If $f(x) = ax^2 + bx + c$ **then** $h = -\frac{b}{2a}$ **and** $k = f\left(-\frac{b}{2a}\right) = c - \frac{b^2}{4a}$

Functions, Theorems, and Concepts

Leading Coefficient Test for n^{th} degree polynomial functions:

For n odd and $a_n > 0$, graph falls to the left and rises to the right

For n odd and $a_n < 0$, graph rises to the left and falls to the right

For n even and $a_n > 0$, graph rises to the left and rises to the right

For n even and $a_n < 0$, graph falls to the left and falls to the right

x-intercepts occur where $f(x) = 0$; y-intercepts occur, where $x = 0$

Even Functions: $f(-x) = f(x)$ symmetric with respect to the y-axis

Odd Functions: $f(-x) = -f(x)$ symmetric with respect to the origin

The Remainder Theorem: If the polynomial $f(x)$ is divided by $(x-c)$, then the remainder is $f(c)$.

The Factor Theorem: Let $f(x)$ be the polynomial.

If $f(c) = 0$, then $x-c$ is a factor of $f(x)$. If $x-c$ is a factor of $f(x)$, then $f(c) = 0$

Exponentials and Logarithms

Compound Interest $A = P\left(1 + \frac{r}{n}\right)^{nt}$ **Continuous compounding** $A = Pe^{rt}$

$y = a^x$ **if and only if** $\log_a y = x$

$\log_a MN = \log_a M + \log_a N$ $\log_a \frac{M}{N} = \log_a M - \log_a N$ $\log_a M^r = r \log_a M$

$\log_a a^x = x$ $a^{\log_a x} = x$ $e^{\ln x} = x$ $\ln e^x = x$

$\ln e = 1$ $\log_a 1 = 0$ $\log_b M = \frac{\log M}{\log b}$ $\log_b M = \frac{\ln M}{\ln b}$

Trigonometry

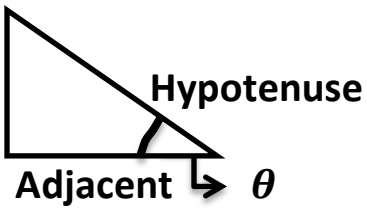
Relationship between degrees and radians:

$\theta_{rad} = \theta_{deg} \cdot \frac{\pi}{180}$ **and** $\theta_{deg} = \theta_{rad} \cdot \frac{180}{\pi}$

Arc Length: $s = r\theta$ **Note**: θ **must be the nonnegative radian measure of the central angle**

The Right Triangle: $\sin\theta = \frac{Opp}{Hyp}$ $\cos\theta = \frac{Adj}{Hyp}$ $\tan\theta = \frac{Opp}{Adj}$

$\sec\theta = \frac{1}{\cos\theta}$ $\csc\theta = \frac{1}{\sin\theta}$ $\cot\theta = \frac{1}{\tan\theta}$



$\tan\theta = \frac{\sin\theta}{\cos\theta}$