Math 160 – Final Exam Formulas Given

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Change of Base Theorem: $\log_b x = \frac{\log_a x}{\log_a b}$

Exponential Growth Model: $N(t) = N_0 e^{kt}$

Newton's Law of Cooling: $T(t) = T_s + (T_0 - T_s)e^{-kt}$

Trig Identities

$\csc(-x) = -\csc x$ $\quad\sec(-x) = \sec x$ $\quad\cot(-x) = -\cot x$

$\sin\left(\frac{\pi}{2} - x\right) = \cos x$ $\quad\cos\left(\frac{\pi}{2} - x\right) = \sin x$ $\quad\tan\left(\frac{\pi}{2} - x\right) = \cot x$

$\csc\left(\frac{\pi}{2} - x\right) = \sec x$ $\quad\sec\left(\frac{\pi}{2} - x\right) = \csc x$ $\quad\cot\left(\frac{\pi}{2} - x\right) = \tan x$

$\tan(x + y) = \frac{\tan x + \tan y}{1 - \tan x \tan y}$ $\quad\tan(x - y) = \frac{\tan x - \tan y}{1 + \tan x \tan y}$

$\tan 2x = \frac{2\tan x}{1 - \tan^2 x}$ $\quad\tan^2 x = \frac{1 - \cos 2x}{1 + \cos 2x}$ $\quad\tan\frac{x}{2} = \frac{1 - \cos x}{\sin x} = \frac{\sin x}{1 + \cos x}$

Components of Vectors

Component of $\vec{u}$ along $\vec{v}$ is $\|\vec{u}\| \cos\theta$ (θ is the angle between $\vec{u}$ and $\vec{v}$)

Component of $\vec{u}$ along $\vec{v}$ can also be calculated using: $\frac{\vec{u}\cdot\vec{v}}{\|\vec{v}\|}$

Projections of Vectors

$\text{proj}_{\vec{v}}\vec{u} = (\text{component of } \vec{u} \text{ along } \vec{v})(\text{unit vector in direction of } \vec{v}) = \left(\frac{\vec{u}\cdot\vec{v}}{|\vec{v}|}\right)\frac{\vec{v}}{|\vec{v}|} = \left(\frac{\vec{u}\cdot\vec{v}}{|\vec{v}|^2}\right)\vec{v}$

Parabolas

$x^2 = 4py$ has focus $(0, p)$ and directrix $y = -p$.

$y^2 = 4px$ has focus $(p, 0)$ and directrix $x = -p$.

Focal diameter: $|4p|$

Arithmetic Sequences

$S_n = \frac{(a_1 + a_n)\cdot n}{2}$

Geometric Sequences

$S_n = \frac{a(1 - r^n)}{1 - r}$

Binomial Coefficient: $\binom{n}{r} = \frac{n!}{r!(n-r)!}$

Binomial Theorem: $(a + b)^n = \binom{n}{0}a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \cdots + \binom{n}{n-1}ab^{n-1} + \binom{n}{n}b^n = \sum_{k=0}^{n}\binom{n}{k}a^{n-k}b^k$

The term that contains a^{n-k} in the expansion of $(a + b)^n$ is: $\boldsymbol{\binom{n}{k}a^{n-k}b^k}$