Vector, Polar, and Parametric Functions

$x(t)$ and $y(t)$ are parametric functions

$\frac{dy}{dx} =$

Vector, Polar, and Parametric Functions

$x(t)$ and $y(t)$ are parametric functions

$\frac{d^2y}{dx^2} =$

Vector, Polar, and Parametric Functions

Velocity vector if position vector is $\langle x(t), y(t) \rangle$

Vector, Polar, and Parametric Functions

Acceleration vector if position vector is $\langle x(t), y(t) \rangle$

Vector, Polar, and Parametric Functions

Speed if position vector is $\langle x(t), y(t) \rangle$

Vector, Polar, and Parametric Functions

Given an initial position $x(a)$ and a horizontal velocity $x'(t)$, $x(b) =$

Vector, Polar, and Parametric Functions

Given an initial position $y(c)$ and a vertical velocity $y'(t)$, $y(d) =$

Vector, Polar, and Parametric Functions

Total distance traveled from $t = a$ to $t = b$ (parametric)

Vector, Polar, and Parametric Functions

Arc Length of a curve f on $[a, b]$ (rectangular)

Vector, Polar, and Parametric Functions

Arc Length of a parametric curve $\begin{cases} x(t) \\ y(t) \end{cases}$ from $t = a$ to $t = b$

$$\frac{\frac{d}{dx}\left(\frac{dy}{dx}\right)}{\frac{dx}{dt}}$$	$$\frac{\frac{dy}{dt}}{\frac{dx}{dt}}$$
$$a(t) = \langle x''(t), y''(t) \rangle$$	$$v(t) = \langle x'(t), y'(t) \rangle$$
$$x(b) = x(a) + \int_a^b x'(t)dt$$	$$\sqrt{(x'(t))^2 + (y'(t))^2}$$
$$\int_a^b \sqrt{(x'(t))^2 + (y'(t))^2}\, dt$$	$$y(d) = y(c) + \int_c^d y'(t)dt$$
$$\int_a^b \sqrt{(x'(t))^2 + (y'(t))^2}\, dt$$	$$\int_a^b \sqrt{1 + (f'(x))^2}dx$$

Vector, Polar, and Parametric Functions

Slope of tangent line
to a polar function $r(\theta)$

Vector, Polar, and Parametric Functions

Polar Area
(one function)

Vector, Polar, and Parametric Functions

Polar Area
(two functions)

Infinite Series

Sum of a
Geometric Series

Infinite Series

Converge or diverge?

$$\sum_{n=1}^{\infty} \frac{1}{n}$$

Infinite Series

Converge or diverge?

$$\sum_{n=1}^{\infty} \frac{1}{n^p}$$

Infinite Series

Converge or diverge?

$$\sum_{n=1}^{\infty} ar^n$$

Infinite Series

Nth Term Test for
$\sum_{n=1}^{\infty} a_n$

Infinite Series

Limit Comparison Test
for $\sum_{n=1}^{\infty} a_n$
(compare to $\sum_{n=1}^{\infty} b_n$)

Infinite Series

Ratio Test for
$\sum_{n=1}^{\infty} a_n$

$A = \frac{1}{2}\int_{\theta_1}^{\theta_2} (r(\theta))^2 d\theta$	$\frac{dy}{dx} = \frac{dy/d\theta}{dx/d\theta}$ (Use $x = r\cos\theta$ and $y = r\sin\theta$ to convert first)
$S = \frac{1}{1-r}$	$A = \frac{1}{2}\int_{\theta_1}^{\theta_2} (r_{outer}(\theta))^2 - \left(r_{inner}(\theta)\right)^2 d\theta$
Converges if $p > 1$ Diverges if $p \leq 1$ P-series	Diverges Harmonic series
If $\lim_{n\to\infty} a_n \neq 0$, the series diverges	Converges if $\lvert r\rvert < 1$ Geometric series
If $\lim_{n\to\infty} \frac{a_{n+1}}{a_n} < 1$, the series converges	If $\lim_{n\to\infty} \frac{a_n}{b_n}$ is a finite, positive value, both series converge or both diverge

Infinite Series

Alternating Series Test
for $\sum_{n=1}^{\infty} a_n$

Infinite Series

Absolute
Convergence

Infinite Series

Conditional
Convergence

Infinite Series

Nth term
of a Taylor Polynomial
centered at $x = a$

Infinite Series

Power Series
for $\sin x$

Infinite Series

Power Series
for $\cos x$

Infinite Series

Power Series
for e^x

Integration Techniques

Integration by Parts

$$\int udv =$$

Integration Techniques

Improper Integrals

Integration Techniques

Which method would you use?

$$\int x \sin x \, dx$$

Both $\sum_{n=1}^{\infty} \lvert a_n \rvert$ and $\sum_{n=1}^{\infty} a_n$ converge	If the series is alternating and $\lim_{n\to\infty} a_n = 0$, the series converges
$\frac{f^n(a)}{n!}(x-a)^n$	Either $\sum_{n=1}^{\infty} \lvert a_n \rvert$ or $\sum_{n=1}^{\infty} a_n$ converges
$1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \cdots + \frac{(-1)^n x^{2n}}{(2n)!}$	$x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \cdots + \frac{(-1)^n x^{2n+1}}{(2n+1)!}$
$uv - \int v\, du$	$1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots + \frac{x^n}{n!}$
Integration by Parts	$\int_a^{\infty} f(x)dx = \lim_{b\to\infty} \int_a^b f(x)dx$

Integration Techniques

Which method would you use?

$$\int_0^2 \frac{1}{x}\,dx$$

Integration Techniques

Which method would you use?

$$\int \frac{3x}{x^2 - x - 12}\,dx$$

Integration Techniques

Which method would you use?

$$\int \ln x\,dx$$

Integration Techniques

Which method would you use?

$$\int_2^\infty \frac{3}{x^2}\,dx$$

Integration Techniques

Which method would you use?

$$\int x^4 e^{2x}\,dx$$

Integration Techniques

Which method would you use?

$$\int \frac{1}{(2x-1)^2}\,dx$$

Partial Fractions	Improper Integral
Improper Integral	Integration by Parts
U-Substitution	Integration by Parts