

Sample Problems

1. Test the series $\sum_{n=1}^{\infty} \frac{n!(2n)!}{(3n)!}$ for convergence. If it converges, find the sum.
2. Find the Maclaurin polynomial for $f(x) = \sin x$ with various numbers of terms and plot them on the same graph with $f(x)$.
3. The formula below gives the amount of the monthly payment for a loan amount A, interest rate r, and number of months in the loan term, n.

$$P = \frac{A \left(1 + \frac{r}{12}\right)^n \frac{r}{12}}{\left(1 + \frac{r}{12}\right)^n - 1}$$

Solve the formula for A, and use it to determine how much can be borrowed for a term of 36 months, interest rate of 10%, and a monthly payment of \$300.

4. Find the length of the curve $x^{2/3} + y^{2/3} = 1$, $0 \leq x \leq 1$.
5. Find the critical points of $f(x, y) = x^2 - xy^2 - y^3 - 2x + 3$.
6. The following sequence of commands will plot a function, its derivative, and its tangent line. Click on the plot and use the toolbar to animate the tangent line.

```
with(plots):  
q:=(f(x0+h)-f(x0))/h:  
m:=limit(q,h=0):  
tanline:=x->f(x0)+m*(x-x0):  
f:=x->-x^2+4:  
a:=plot(f(x),x=-2..2,y=-4..6,color=red,thickness=2):  
b:=plot(D(f)(x),x=-2..2,color=blue,thickness=2):  
c:=animate(tanline(x),x=-2..2,x0=-2..2,color=green,thickness=2):  
display({a,b,c});
```

