Taylor Polynomials in Maple

Hit return at the end of each Maple command line (the commands are in red).

```
> with(Student[Calculus1]): with(plots):
```

Taylor polynomials for sin(x) about x=0

Maple can compute Taylor polynomials of degree n very fast. Here n=15, and we are computing the Taylor polynomial for sin(x) about x=0, like we did in class:

```
> TaylorApproximation(sin(x), x = 0, order=15);
```

We can also plot in Maple. First plot the linear approximation (Taylor polynomial of degree 1), and then plot of the 15th degree Taylor polynomial approximation:

```
> TaylorApproximation(sin(x), x = 0, order=1,output=plot);
> TaylorApproximation(sin(x), x = 0, order=15,output=plot);
```

Where did f(x) go here? Well it is such a good approximation at that point, that the difference between the polynomial and the function is not observable near x=0 within this small (local) plotting area. The functions would separate further away from 0.

Taylor polynomials for sin(x) about x=1

Want to change what x=a is? No problem. Here is the 2nd degree polynomial for sin(x) about x=1:

```
> TaylorApproximation(sin(x), x = 1, order=2);
```

Where does the 1/2 coefficient of sin(1) come from? Well Maple collects terms.

By hand activity: Compute the 2nd degree polynomial for sin(x) about x=1 by hand on paper:

$$f(1) + f'(1)\,(x-1) + f^{(2)}(1)\,\frac{1}{2!}\,(x-1)^2$$

Show work, be sure to foil it out, collect like terms, and then compare with Maple's answer. Is your answer the same or different than Maple's?

Let's compare with the plot:

```
> TaylorApproximation(sin(x), x = 1, order=2,output=plot);
```

Taylor polynomials for arctan(x) about x=0

Use Maple commands to find the 11th degree polynomial that approximates arctan(x) at x=0. It might help to copy and paste a command from above and then modify it.

Now use Maple commands to compare with the plot.

By hand activity: Next, using your Maple responses from above, write the general series form for the Taylor polynomial of degree n, like James Gregory did for this series back in 1671.

Taylor polynomials for exp(x) about x=2

```
> TaylorApproximation(exp(x), x = 2, order = 2);
```

Compare this with our class work on the Taylor polynomial of degree n for exp(x) - show that this would be the same result we obtained by hand when n=2.