1. Find the derivative of $f(x) = \frac{\sin(x)\cos(x)}{x^3+x}$ ← product rule and quotient rule.

Use a "holding pattern" approach.

$$f'(x) = \frac{(x^3+x)\cdot \frac{d}{dx}[\sin(x)\cos(x)] - \sin(x)\cos(x)(3x^2+1)}{(x^3+x)^2}$$

$$= \frac{(x^3+x)\left(\sin(x)(-\sin(x)) + \cos(x)(\cos(x))\right) - \sin(x)\cos(x)(3x^2+1)}{(x^3+x)^2}$$

find x where $f'(x)=0$

2. Determine where the graph $f(x) = \frac{5x^3}{x^2+2}$ has a horizontal tangent.

$$f'(x) = \frac{(x^2+2)(15x^2) - 5x^3(2x)}{(x^2+2)^2} = \frac{15x^4+30x^2-10x^4}{(x^2+2)^2} = \frac{5x^4+30x^2}{(x^2+2)^2}$$

$$= \frac{5x^2(x^2+6)}{(x^2+2)^2} = 0 \text{ ; So } 5x^2(x^2+6) = 0 \text{. So } 5x^2 = 0 \text{ or } x^2+6=0$$

So $x=0$.

- illustrates the sort of algebra we will need
- how to handle fractions
- the value of factoring

3. Come up with an example that demonstrates why $\frac{d}{dx}[f(x)g(x)] \neq \frac{d}{dx}[f(x)]\,\frac{d}{dx}[g(x)]$.

Pick $f(x)=x$, $g(x)=x^2$.

So $f(x)\cdot g(x) = x^3$. And $\frac{d}{dx}[x^3] = 3x^2$.

But $f'\cdot g' = 1\cdot 2x = 2x$

These are not the same.