1. ACME has determined that if they charge a price of x dollars per widget, then they will sell $\dfrac{10000}{1+x^2}$ widgets.

a) Find a function for the (gross) profit $P(x)$ of the sale of widgets at price x.

b) What are the units of $P'(x)$? Calculate $P'(x)$.

c) What does it mean if $P'(x) > 0$? On what interval is $P'(x) > 0$?

d) What does it mean if $P'(x) < 0$? On what interval is $P'(x) < 0$?

e) What price should ACME charge in order to maximize their profit?

2. Find an equation for the tangent line to $f(x) = x \cos x \sin x$ at the point $\left(\dfrac{\pi}{4}, \dfrac{\pi}{8}\right)$.

3. Calculate the derivative $\frac{d}{dx}\left[\frac{\sin 2x}{x}\right]$ (you may want to use the double angle formula $\sin 2x = 2\sin x \cos x$).

4. Let f be a differentiable function.

a) Use the product rule to find $\frac{d}{dx}\left[(f(x))^2\right]$ (in terms of f and f').

b) Use the product rule to find $\frac{d}{dx}\left[(f(x))^3\right]$ (in terms of f and f').

c) Use the product rule to find $\frac{d}{dx}\left[(f(x))^4\right]$ (in terms of f and f').

d) Make a guess about the general formula for $\frac{d}{dx}\left[(f(x))^n\right]$.