

Math 220 Worksheet One
Saturday, 1 September

Let $f(x) = x^2$. Recall in class we investigated the quotient

$$\frac{f(x+dx)-f(x)}{dx} \text{ as } dx \text{ approaches to zero.}$$

We found that the quotient approaches to $2x$; we call this the derivative at x , and write

$$\frac{df}{dx}(x) = 2x.$$

In particular, at $x = 3$ the derivative is $2(3) = 6$; this means that for x near 3, so $x = 3 + dx$ for some small real number dx , the value

$$\frac{f(x)-f(3)}{x-3} = \frac{f(3+dx)-f(3)}{dx} \approx 6.$$

The following questions will help guide you in some investigations which should hopefully help you understand this interpretation of the derivative.

Let $v(x) = 6x$ and $V(x) = f(3 + x) - 9$. Consider the following questions.

- (1) What do v and V represent? It may help here to sketch the graph of both f and $T(x) = v(x - 3) + 9$.
- (2) For $-1 \leq x \leq 1$, compare $v(x)$ and $V(x)$.
 - (a) Is one number easier to compute for each x ? If so, which one and why?
 - (b) Are the values fairly close together for each x ? When are they closest?
- (3) Try some other values, like at -1 , 0 , or 2 and repeat the above with the appropriate adjustments. If you're not sure how to adjust, you may need to look to the first set of questions again, as you may not fully understand what T is and what the point of the comparison is.