

Supplemental Problems:  
Difference Quotients, Secants, and Tangents

1. For each function below, find the difference quotient,  $\frac{f(x+h) - f(x)}{h}$ .

a)  $f(x) = 3$

b)  $f(x) = 3x$

c)  $f(x) = 3 - x$

d)  $f(x) = x^2 + 1$

e)  $f(x) = 2x - x^2$

f)  $f(x) = x^2 - 3x + 2$

2. For each function in problem 1), find the slope of the secant line through:

i)  $x = 1$  and  $x = 2$

ii)  $x = 1$  and  $x = 1.5$

iii)  $x = 1$  and  $x = 1.1$

Hint: Recall that the secant line to  $f$  through  $x = a$  and  $x = b$  is the line through the points  $(a, f(a))$  and  $(b, f(b))$ . Hence, we have:

$$\text{slope of secant } x = a \text{ and } x = b = \frac{f(b) - f(a)}{b - a}$$

3. For each function in problem 1), find the slope of the tangent line at  $x = 1$ .

Hint: Recall that the slope of the tangent line to  $f$  at  $x = a$  is:

$$\text{slope of tangent at } x = a = \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h}$$

4. Find the slope of the tangent line to the given function at the point indicated:

a)  $f(x) = 2x - 5$  at  $x = 1$

b)  $f(x) = 2x - 5$  at  $x = 2$

c)  $f(x) = x^2 - 2x$  at  $x = 0$

d)  $f(x) = x^2 - 2x$  at  $x = 1$

e)  $f(x) = x^2 - 2x$  at  $x = 3$

f)  $f(x) = x^2 + 7x - 1$  at  $x = -2$

g)  $f(x) = x^2 - 3x + 4$  at  $x = 5$

h)  $f(x) = 9 - x^2$  at  $x = -1$

i)  $f(x) = x - x^2$  at  $x = -3$

**Some Answers:**

1. a) 0 b) 3 c) -1 d)  $2x + h$  e)  $2 - 2x - h$  f)  $2x + h - 3$

2. a) 0, 0, 0 b) 3, 3, 3 d) 3, 2.5, 2.1 (slopes should 'approach' those in problem 3)

3. a) 0 b) 3 c) -1 d) 2 e) 0 f) -1

4. a) 2 b) 2 c) -2 d) 0 e) 4 f) 3 g) 7 h) 2 i) 7