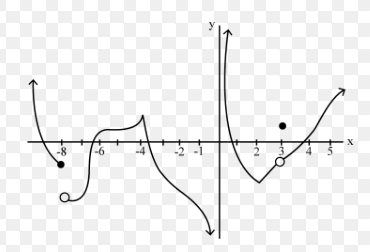
**Chapter 3 TEST**

1. Consider the following graph of function *f*. [3]  
   

a) Determine where the function is discontinuous.  
  
  
  
b) Determine the intervals where the function is increasing.  
  
  
  
c) Determine where the function is not differentiable.

1. a) Determine the slope of at the point . [1]  
     
     
     
     
   b) Find the equations of the tangent lines to its graph that have a slope 3. [2]
2. Find all points on the curve where the tangent line is perpendicular to the line .  
    [2]
3. a) Let .  
   Use the definition of the derivative to determine . [2]  
     
     
     
     
     
     
     
     
   b) Let .  
   Use the alternate definition of the derivative to determine . [2]
4. Determine the derivatives of the following functions: [13]  
     
   a)   
     
     
     
   b)   
     
     
     
   c)   
     
     
     
     
   d)   
     
     
     
     
     
   e)   
     
     
     
     
     
   f)   
     
     
     
     
     
     
     
   g)   
     
     
     
     
     
   h)   
     
     
     
     
   i)   
     
     
     
     
   j)

k)   
  
  
  
  
l)   
  
  
  
  
m)

1. a) Determine if [1]  
     
     
     
     
     
   b) Express the derivative of function in terms of and . [1]  
     
     
     
     
     
   c) Express the derivative of function in terms of and . [1]  
     
     
     
     
     
     
     
     
     
   d) Determine for [1.5]  
     
     
     
     
     
     
     
     
   e) Find an equation of the normal line to the curve at point . [2.5]  
     
     
     
     
     
     
     
     
     
     
     
     
     
     
     
     
     
   g) Find if . [2]
2. A point moves along the *x*-axis so that its position *x* at time *t* is given by .   
   Determine: [6]  
   a) the position of the particle at the start.  
     
     
   b) the initial velocity of the particle.  
     
     
     
   c) the time intervals on which the point is moving to the right.  
     
     
     
     
     
     
     
     
     
   d) the time intervals on which the point is speeding up. Justify.  
     
     
     
     
     
     
     
     
   e) the average velocity over the time interval [0,4].  
     
     
     
     
   f) At what instant is the velocity equal to the average velocity over [0,4].