AP Calculus AB   **Name**:_____
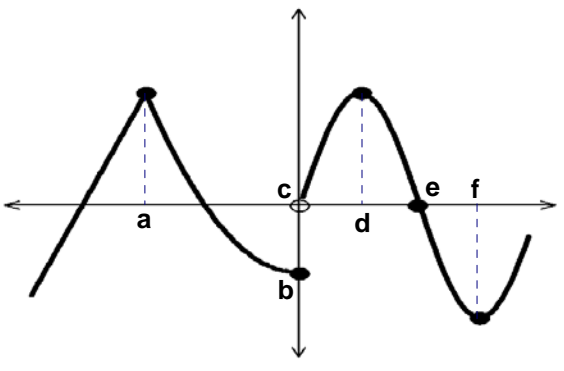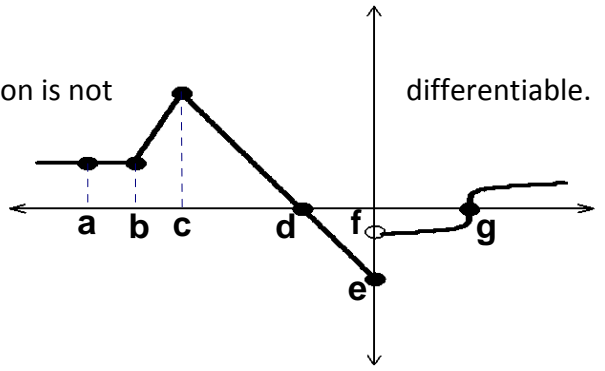
1) What are the three ways for a function to fail to be differentiable at a particular point $P(c, f(c))$:
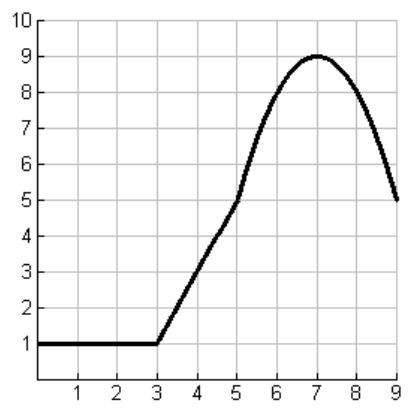
   a) _____

   b) _____

   c) _____

2) Use the graph to determine all x-values at which the function is not differentiable. Explain each answer.

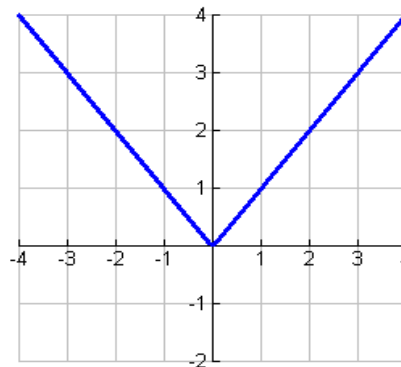3) Use the graph to determine all x-values at which the function is not differentiable. Explain each answer.

4) Let f(x) be the function whose graph is shown in the figure.
   (a) Determine: $f'(1) =$_____ , $f'(2) =$_____, $f'(4) =$_____, $f'(7) =$_____.
   (b) Estimate: $f'(6) =$_____, $f'(8) =$_____.
   (c) Does $f'(3)$ exist?_____ Explain.

5) Use the given graph to estimate the value of each derivative.
   sketch the graph of f'.
   (a) $f'(-3) =$_____ (b) $f'(-2) =$_____
   (c) $f'(-1) =$_____ (d) $f'(0) =$_____
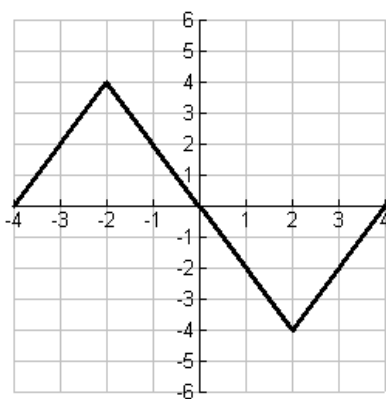   (e) $f'(1) =$_____ (f) $f'(2) =$_____
   (g) $f'(3) =$_____

Then

6) Use the given graph to estimate the value of each derivative. Then
   sketch the graph of f'.

   (a) $f'(-3) =$_____ (b) $f'(-2) =$_____
   (c) $f'(1) =$_____ (d) $f'(0) =$_____
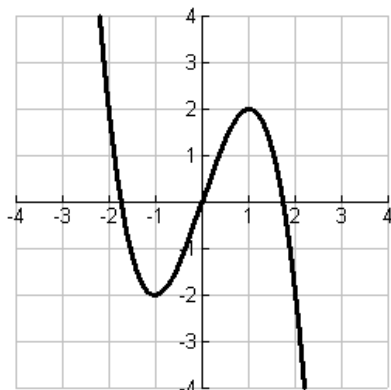   (e) $f'(1) =$_____ (f) $f'(2) =$_____
   (g) $f'(3) =$_____

7) Use the given graph to estimate the value of each derivative. Then sketch
   the graph of f'.
   (a) $f'(-3) =$_____(b) $f'(-2) =$_____
   (c) $f'(-1) =$_____(d) $f'(0) =$_____
   (e) $f'(1) =$_____ (f) $f'(2) =$_____
   (g) $f'(3) =$_____

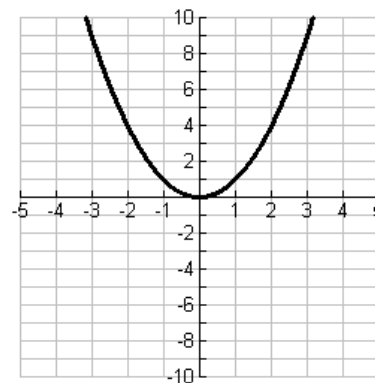8) Use the given graph to estimate the value of each derivative. Then
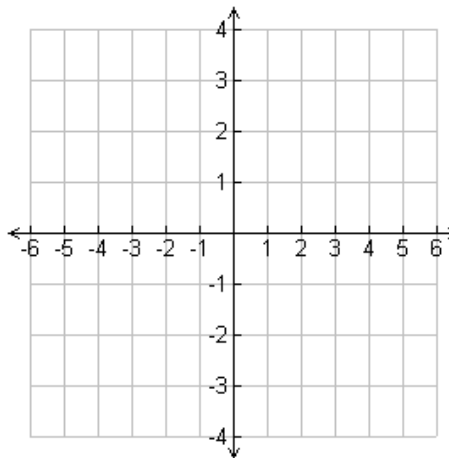   sketch the graph of f'.

   (a) $f'(-2) =$_____
   (b) $f'(-1) =$_____
   (c) $f'(0) =$_____
   (d) $f'(1) =$_____
   (e) $f'(2) =$_____

9) Let $f(x) = \sqrt[3]{x}$.
   (a) Sketch the graph of f(x).
   (b) Find $f'(x)$

   (c) Show that $f'(0)$ does not exist.

Definition of derivative

The derivative of $f(x)$ with respect to x is $f'(x) = \lim\limits_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$ provided the limit exists. The process of calculating a derivative is called **differentiation**.

10) Find the derivative of the function using the definition of derivative: $f(x) = x^2 - x$
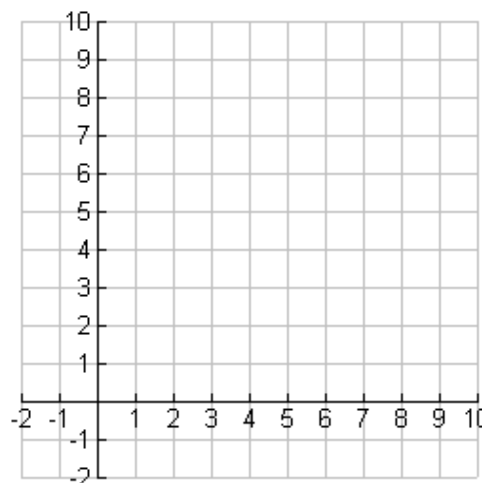
11) For $f(x) = \sqrt{x}$
    (a) Find $f'(x)$ using the definition of derivative.

    (b) State the domain of
    i) $f(x)$.
    ii) $f'(x)$.

(c) Sketch the graph of

   i) $f(x)$
   ii) $f'(x)$

12) Use the Power Rule to compute the derivative.

   (a) $f(x) = x^3 + 4x^2 - 3x + 56$ $\qquad$ (b) $f(x) = \dfrac{1}{x^3}$ $\qquad$ (c) $f(x) = \sqrt[4]{x}$

13) Find $\dfrac{dy}{dx} : y = 6\cos(x) - 2\sin(x)$

14) Find the point on the curve $f(x) = x^2 + 3x - 7$ at which the slope of the tangent line is horizontal.

15) Find the point on the curve $f(x) = x^2 + 3x - 7$ at which the slope of the tangent line is equal to 4.

16) Given $f(x) = 4x - x^2$.

(a) Find the slope of the tangent line to the parabola $f(x) = 4x - x^2$ at the point (1, 3).

(b) Find the equation of the tangent line in part (a).

17) If $f(2)=6 \ and \ f'(x)=-3,$ find an equation of the tangent line when x = 2. Solve the equation for y.

18) If a ball is thrown into the air with a velocity of 40ft/sec, its height (in feet) after t seconds is given by $y = 40t - 16t^2$. Find the velocity when t = 2.