Unit 3 Keeper Pictures

SLOPE OF THE TANGENT LINE

$$m_{tan} = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$$

This formula represents the **INSTANTANEOUS** rate of change

DEFINITION OF A DERIVATIVE AT A POINT $(a, f(a))$

$$f'(a) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$$

When to use this version:

-you are given a specific x value to evaluate the derivative at.

DERIVATIVE

-Slope of a tangent line at $x = a$

-Rate of change at $x = a$

-Instantaneous rate of change or derivative

-Denoted by y', $f'(x)$, or $\frac{dy}{dx}$

TANGENT AND NORMAL EQUATIONS

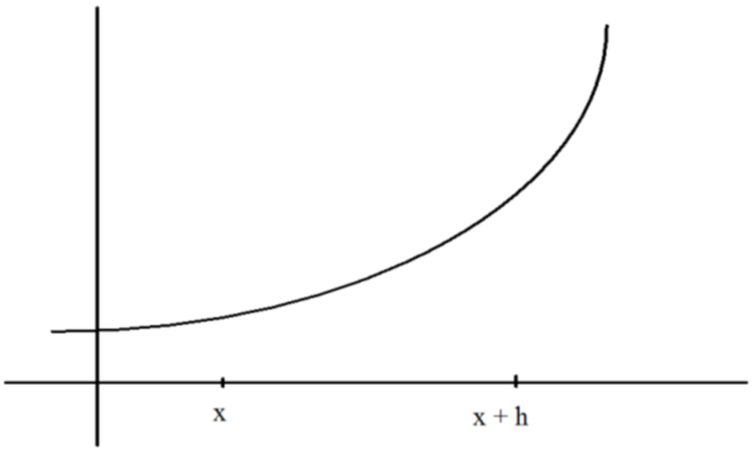
To find the **tangent equation**:

-find the slope of the tangent line (find the derivative)

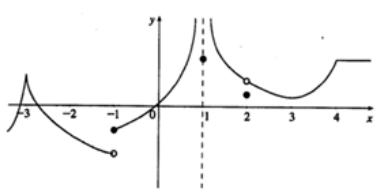
-input the slope and the point into the point-slope form of a line (no need to simplify)

To find the equation of the **normal line**:

- Find the slope of the tangent line (find the derivative)
- Find the slope of the line perpendicular to the tangent line (negative reciprocal)
- Input the slope and the point into the point-slope form of a line (no need to simplify)



STATE THE X VALUES WHERE f IS NOT DIFFERENTIABLE AND THE REASON



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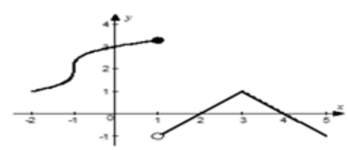
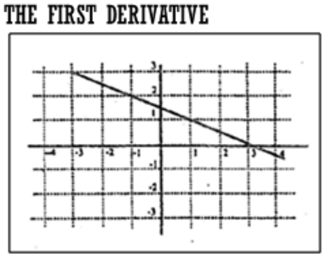


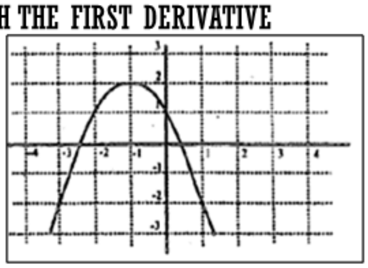
RELATIONSHIP BETWEEN f, f', f''

f	f'	f''
-Cusp -Corner -Discontinuity -Removable -Infinite -jump -Vertical Tangent	DNE	DNE
Local max, local min (local extrema), horizontal tangent	0 On the x-axis	
f increasing	Positive (Above the x-axis)	
f decreasing	Negative (Below the x-axis)	
f concave up	Increasing	Positive (Above the x-axis)
f concave down	Decreasing	Negative (Below the x-axis)
Points of Inflections	Local Extrema	Change Signs

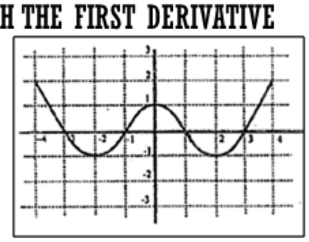
1. GRAPH THE FIRST DERIVATIVE



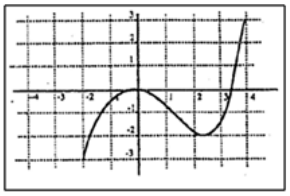
2. GRAPH THE FIRST DERIVATIVE



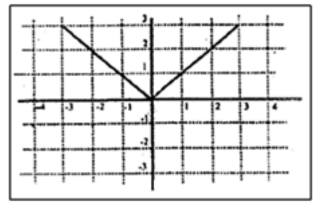
3. GRAPH THE FIRST DERIVATIVE



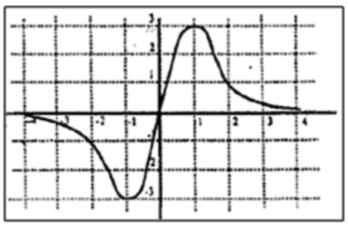
4. GRAPH THE FIRST DERIVATIVE



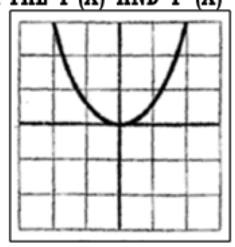
5. GRAPH THE FIRST DERIVATIVE



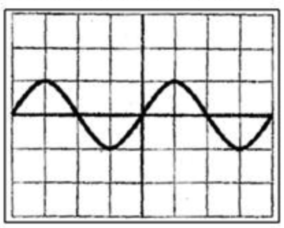
6. GRAPH THE FIRST DERIVATIVE

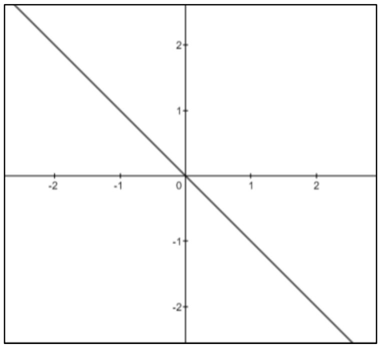


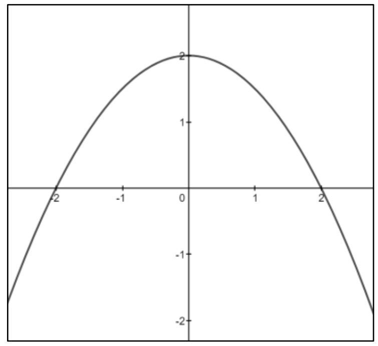
7. GRAPH THE F'(X) AND F''(X)

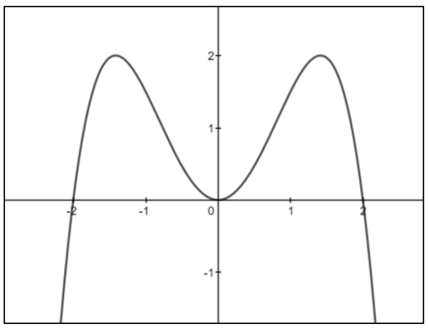


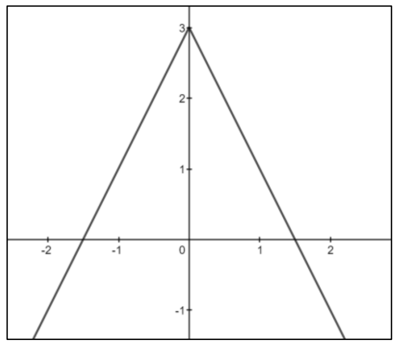
8. GRAPH THE F'(X) AND F''(X)











1. a. $f(x)$ is continuous

   b. $f(3) = 2$

   c. $f'(x) > 0, (-\infty, 0) \cup (3, \infty)$

   d. $f'(x) < 0, (0, 3)$

   e. $f'(x) = 0$ at $x = 0$ & $x = 3$

2. a. $f(x)$ is continuous

   b. $f'(x) < 0,\ (-\infty, 1)$

   c. $f'(x) > 0,\ (1, \infty)$

   d. $f'(x)$ is undefined at $x = 1$

   e. $f''(x) < 0, (-\infty, 1) \cup (1, \infty)$

3. a. $f(x)$ is continuous

   b. $f'(x) < 0, (-\infty, 2) \cup (2, \infty)$

   c. $f'(x)$ is undefined at $x = 2$

   d. $f''(x) < 0$ when $x < 2$

   e. $f''(x) > 0$ when $x > 2$

4. a. $f(x)$ has a jump disc. at x = -2

   b. $f'(x) > 0, (-\infty, -2) \cup (-2, \infty)$

   c. $f''(x) < 0, (-\infty, -2)$

   d. $f''(x) > 0, (-2, \infty)$

5. a. $f(x)$ is continuous at [-4, 3]

   b. $f'(x) < 0$ on $(-4, -2)$

   c. $f'(x) > 0, (-2, 1) \cup (1, 3)$

   d. $f'(x)$ is undefined at $x = -2$

   e. $f(-2) = -3$ and $f(1) = 3$

   f. $f'(x) = 0$ at $x = 1$

   g. $f''(x) < 0$, on $(-4, -2) \cup (-2, 1)$

   h. $f''(x) > 0,$ on $(1, 3)$