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$4x^3 = 0$

Determine if true or false for each of the following statements. (5 points each)

- ~~F~~ The function  $f(x) = x^4 - 4$  has a relative maximum at  $(0, -4)$
- ~~T~~ If "a" is a critical point of the function  $f(x)$  that is continuous, and if  $f'(x) < 0$  at  $(-\infty, a)$  and  $f'(x) > 0$  at  $(a, \infty)$ , then,  $f(x)$  has a relative minimum at  $(a, f(a))$ .
- ~~T~~ Let  $f$  be a function whose second derivative exists on an open interval, if  $f''(x) > 0$  for all  $x$  in that interval, then the graph of  $f$  is concave upward on that interval.
- ~~T~~ The function  $f(x) = -3x^3 - 3x^2 + 14$  has only one critical point.

$f'(x) = 4x^3$   $f''(x) = 12x^2$

$f'(x) = -9x^2 - 6x$   $f''(x) = -3x(3x + 2)$   
 $x = 0$   $x = -\frac{2}{3}$

Choose the right answer (10 points each)

- ~~D~~ If  $(c, f(c))$  is a critical point, then  
 A)  $f'(c) = 0$  B)  $f'(c) < 0$  C)  $f'(c) > 0$  **D)  $f'(c) = 0$**
- ~~B~~ According to the second derivative test if  $f''(c) > 0$ , then  
 A)  $f(c)$  is concave downward.  
 B)  $f(c)$  is relative maximum.  
 C)  $f(c)$  is a critical point.  
 D)  $f(c)$  is a relative minimum.
- ~~A~~ The function  $f(x) = 20x - x^2$  has a critical point:  
 A)  $x = 10$  B)  $x = -10$  C)  $x = 0$  D)  $x = 1$
- ~~A~~ If  $(f''(x) > 0)$  then  $f(x)$  is:  
 A) concave upward B) concave downward C) decreasing D) increasing
- ~~B~~ It can be determined if the curve of  $y = f(x)$  has a change of concavity:  
 A) Critical point B) Inflection point C) x-intersect D) y-intercept
- ~~B~~ The function  $y = -x^3 + 6x^2$  has a relative minimum at:  
 A)  $(4, -32)$  B)  $(0, 0)$  C)  $(4, 32)$  D)  $(6, 0)$
- ~~D~~ The function  $y = x^3 - 3x^2$  has a relative maximum at:  
 A)  $(1, -2)$  B)  $(3, 0)$  C)  $(0, 0)$  D)  $(2, -4)$

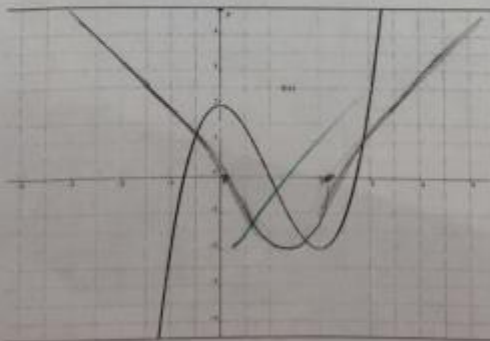
$f'(x) = -2x + 20$   $x = -\frac{-20}{-2} = 10$

$y' = -3x^2 + 12x$   
 $y'' = -6x + 12$

$y' = 3x^2 - 6x$   $y'' = 6x - 6$   
 $3x^2 - 6x = 0$   
 $3x(x - 2) = 0$   
 $x = 0$   $x = 2$

Answer the following showing your entire procedure.

- The following graph represents  $f(x)$  use it to sketch the graphs of  $f'(x)$ . (10 points)



$y'' = -6(0) + 12$   
 $y'' = -6(2) + 12$   
 $\min(0, -)$   
 $\max($