MATH 110-003, QUIZ 3

October 20, 2016
Time: 15 minutes

Show all your work. No calculators, no books/notes are allowed.

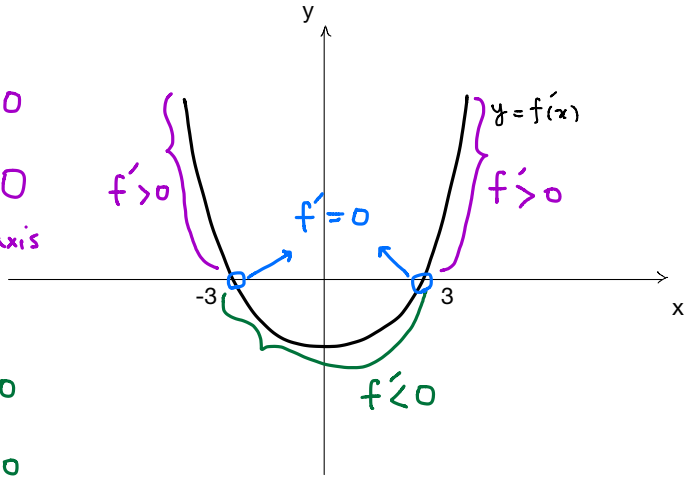
Name (please print): _____

Student number: _____

1. The graph of the derivative f' is shown below. Answer the following questions about the function **f**.

f increasing → $m_{tan} > 0$ → $f'(x) > 0$ → above y-axis

f decreasing → $m_{tan} < 0$ → $f'(x) < 0$ → below y-axis



a) For what values of x is f increasing? $x < -3$ and $x > 3$

$(-\infty, -3)$ and $(3, +\infty)$ ← Interval notation

b) For what values of x is f decreasing? $-3 < x < 3$ or $(-3, 3)$

c) For what values of x does f have a horizontal tangent line? $x = -3$ and $x = 3$

(*Hint: The answer to each part can be an interval.*)

2. Let f be the function $f(x) = x^3 - 3x$

(a) Find all points on the graph at which the tangent line to f is parallel to the line $y = 9x + 4$.(Find both x and y coordinates of the points.)

(b) Write the equation of the tangent line to f at the point with positive x-coordinate from part (a).

(a)

tangent line parallel to $y = 9x + 4$

$\Rightarrow m_{tan} = 9$ (9 is the slope)

$\Rightarrow f'(x) = 9$

On the other hand $m_{tan} = f'(x)$

Use power rule, find $f'(x)$ and solve the equation.

$f(x) = x^3 - 3x \Rightarrow f'(x) = 3x^2 - 3$

$f'(x) = 9$

$\Rightarrow 3x^2 - 3 = 9$

$\Rightarrow 3x^2 = 12$

$\Rightarrow x^2 = 4$

$\Rightarrow x = 2 \quad , \quad x = -2$

plug into f $\Rightarrow$ $y = 2^3 - 3(2) = 2$, $y = (-2)^3 - 3(-2) = -2$

$(2, 2)$, $(-2, -2)$

(b) $(2,2)$ is the point with positive x-coordinate

$(m_{tan} \text{ at } x = 2) = f'(2) = 3(2)^2 - 3 = 9$ ($f'(x) = 3x^2 - 3$)

$y - y_1 = m_{tan}(x - x_1)$

$y - 2 = 9(x - 2) \rightsquigarrow \boxed{y = 9x - 16}$

You can skip this part and just use the fact that: tangent line is parallel to $y = 9x + 4$ so $m_{tan} = 9$