Math 176 Midterm Version C  Name: ____________________

**1.** The equation of the line passing through the points $(1, -2)$ and $(3, 1)$ may be written in the form $ax + by = 1$ where

$a =$ [ ] and $b =$ [ ]

**2.** Suppose $f(x) = x - 2$ and $g(x) = 1/x$. Evaluate the composition

$$(f \circ g)(2) = \boxed{\phantom{xx}}$$

**3.** Evaluate the following limits:

$\lim_{x \to 2} \sqrt{2 + 3x} =$ [ ] and $\lim_{x \to 2} \frac{x^2 - 4}{x - 2} =$ [ ]

**4.** Under a set of controlled laboratory conditions, the size of the population $P$ of a certain bacteria culture at time $t$ in minutes is described by $P(t) = 3t^3 + 2t + 1$. The rate of population growth at $t = 19$ minutes is

[ ] bacteria per minute.

**5.** Find the following derivatives:

$\frac{d}{dx}(2x^3 + 5) =$ [ ] $\frac{d}{dx}\sqrt{3 + x^4} =$ [ ]

$\frac{d}{dx}\left[(x + 1)^{1/3}(x + 3)^{1/4}\right] =$ [ ]

**6.** The quotient rule is

(A) $\left(\frac{f}{g}\right)'(x) = \frac{f'(x)g(x) - f(x)g'(x)}{f(x)^2}$

(B) $\left(\frac{f}{g}\right)'(x) = \frac{f'(x)g(x) - f(x)g'(x)}{g(x)^2}$

(C) $\left(\frac{f}{g}\right)'(x) = \frac{g'(x)f(x) - g(x)f'(x)}{f(x)^2}$

(D) $\left(\frac{f}{g}\right)'(x) = \frac{g'(x)f(x) - g(x)f'(x)}{g(x)^2}$

(E) none of these.

**7.** For the demand equation

$$x = -\frac{5}{4}p + 20$$

compute the elasticity of demand $E(p)$ and determine whether the demand is elastic, unitary or inelastic when $p = 10$.

$E(p) =$ [ ] $E(10) =$ [ ]

The demand is

(A) elastic

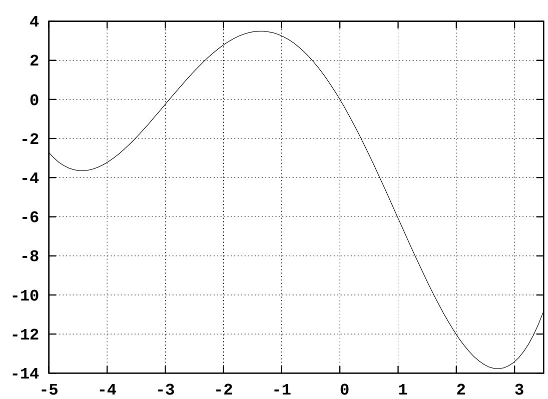
(B) unitary

(C) inelastic

**8.** List all critical values for the function $f(x) = x^2/(x+1)$.

$x =$ [ ]

**9.** Consider the function $y = f(x)$ given by the following graph:




(True/False) The function has a relative minimum at $x = 0$.

(True/False) The function has an inflection point at $x = -3$.

(True/False) The function is concave down on the interval $[-3, 1]$.

**10.** Find the absolute maximum and absolute minimum values of $g(x) = -x^2 - 3x + 2$ on the interval $[-3, 2]$.

absolute maximum = [ ] absolute minimum = [ ]

**11.** Use the limit definition of derivative

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

to explain why the derivative of $f(x) = x^3$ is $f'(x) = 3x^2$.

**12.** Explain the reciprocal rule $(1/g)'(x) = -g'(x)/g(x)^2$ using limits.

**13.** Find the equation of the line tangent to $y^3 - y = x^2 + xy - 1$ at the point $(1, \sqrt{2})$.