MATH 1200 Spring 2017 Exam 4A Name:____________

Show **all your work** to get full/ partial credit. Each problem is worth 5 points unless specified otherwise.

1. Divide, then find the quotient and remainder: $(3x^3 - 11x^2 - 10) \div (x - 4)$

$$\begin{array}{r|rrrr} 4 & 3 & -11 & 0 & -10 \\ & \downarrow & 12 & 4 & 16 \\ \hline & 3 & 1 & 4 & \boxed{6} \end{array}$$

Quotient $= 3x^2+x+4$

Remainder $= 6$

$$\frac{3x^3-11x^2-10}{x-4} = 3x^2+x+4+\frac{6}{x-4}$$

2. Consider the function $f(x) = 5x^2 - 17x - 12$:

a. Use the Remainder Theorem to determine whether $c = 4$ is a zero of $f(x)$.

$$\begin{array}{r|rrr} 4 & 5 & -17 & -12 \\ & \downarrow & 20 & 12 \\ \hline & 5 & 3 & \boxed{0} \end{array}$$

By Remainder theorem 4 is a zero.

b. Is $(x - 4)$ a factor of $f(x)$? Explain your reasoning.

4 is a zero

By Factor theorem

$x-4$ is a factor.

3. Solve the inequalities, write your answers using interval notation:

a. $3x^2 - 2x + 9 \leq 2x(x + 4)$

$3x^2-2x+9-2x(x+4) \leq 0$

$x^2-10x+9 \leq 0$

$(x-9)(x-1) \leq 0$

$[1,9]$

(+) (−) (+)

$\boxed{0}$ 1 $\boxed{5}$ 9 $\boxed{10}$

b. $\frac{x+4}{x-1} < 0$

$(-4, 1)$

(+) (−) (+)

$\boxed{-5}$ −4 $\boxed{0}$ 1 $\boxed{2}$

4. Write a degree 3 polynomial $f(x)$ with zeros $1, -6$, and -3. Leave this polynomial in factored form.

$$f(x) = (x-1)(x+6)(x+3)$$

5. For the function $f(x) = \frac{5x-8}{x^2-4}$,

a. Find the vertical asymptote(s).

$x^2 - 4 = 0$

$x = \pm\sqrt{4}$

$x = 2$

$x = -2$

b. Find the horizontal or slant asymptote

No slant asymptote

Horizontal : $y = 0$ / x-axis

c. Find the x-intercept(s) and the y-intercept.

x-intercept (set $y = 0$)

$\frac{5x-8}{x^2-4} = 0$

$5x - 8 = 0$

$x = 8/5$

$(8/5, 0)$

y-intercept (set $x = 0$)

$y = \frac{-8}{-4} = 2$

$(0, 2)$

6. The amount of pain reliever that a physician prescribes for a child varies directly as the weight of the child. A physician prescribes 250 mg of the medicine for a 50-lb child.

a. Write a variation model using k as the constant of variation.

Amount of medicine $= m$

weight $= w$

$m = kw$

b. Solve for the constant of variation, k

$250 = k\,50$

$k = \frac{250}{50}$

$k = 5$

c. How much medicine should be prescribed for an 80-lb child?

$m = 5w$

$m = 5(80)$

$= 400$ mg

7. Use the definition of a one-to-one function to determine if $f(x) = -3x + 2$ is one-to-one.

$f(a) = f(b)$

$-3a+2 = -3b+2$

$a = b$

Therefore, f is 1-1

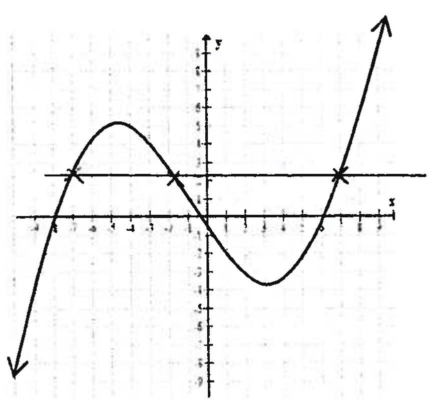
8. Show that the functions $f(x) = 5x + 4$ and $g(x) = \frac{x-4}{5}$ are inverses of each other.

$(f \circ g)(x) = f[g(x)] = 5\left(\frac{x-4}{5}\right)+4 = x$

$(g \circ f)(x) = g[f(x)] = \frac{5x+4-4}{5} = x$

f and g are inverses.

9. The graph of a function $y = f(x)$ is given below. Is the function a one-to-one function? Justify your answer.



The horizontal line hits the graph at more than one

Therefore, f is not 1-1

10. Find the inverse function of $f(x) = \frac{x-8}{3}$

$y = \frac{x-8}{3}$

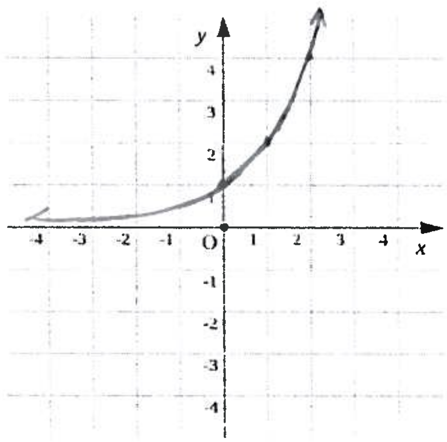
$x = \frac{y-8}{3}$

$3x = y-8$

$y = 3x+8$

$f^{-1}(x) = 3x+8$

11. Graph the function $f(x) = 2^x$



12. Suppose that $3,000 in principal is invested in an account and pays 4.5% interest per year. Write an equation representing the amount in the account after 6 years, compounded quarterly.

$P = 3000$

$r = 4.5\% = \frac{4.5}{100}$

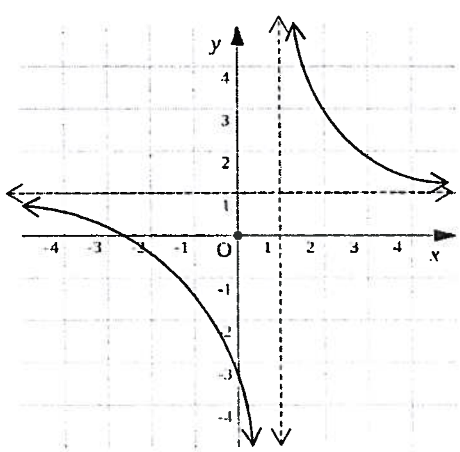
$t = 6$

$n = 4$

$P\left(1+\frac{r}{n}\right)^{nt}$

$3000\left(1+\frac{0.045}{4}\right)^{24}$

13. The graph of $f(x) = \frac{x+4}{x-1}$ is given. Complete the following statements. (2.5 points each)



a. As $x \to -\infty$, $f(x) \to$ 1.

b. As $x \to 1^+$, $f(x) \to$ ∞.

c. As $x \to 1^-$, $f(x) \to$ $-\infty$.

d. As $x \to \infty$, $f(x) \to$ 1.