Precalc 41 Midterm review 2017-2018 Name_____

Complex:

Evaluate/simplify the following complex number expressions. Leave in a + bi form.

1. i^{15} = _____

2. $8i^6 + 4i^5 - 16i^2 + 3i^{-7} - i^{24}$ = _____

Simplify the complex expressions. Leave in a + bi form.

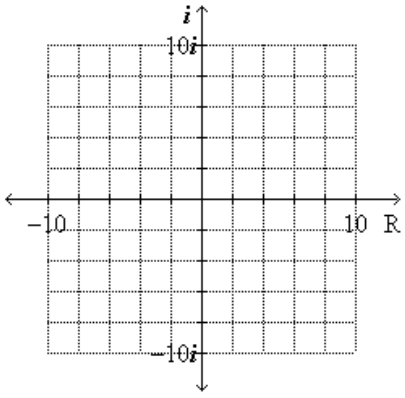
3. $4i(2 + i) + (5 - 2i)$

4. $(3 + 4i) - (-4 + i)$

5. $(2 - 2i)(3 + i)$

6. $\frac{2+3i}{-3+4i}$

7. Graph the number $-3 + 4i$ in the complex plane and find its absolute value.



Matrices:

$A = \begin{bmatrix} -1 & 5 \\ 3 & 0 \end{bmatrix}$ $B = \begin{bmatrix} -4 & 2 & -1 \\ 0 & -5 & 3 \end{bmatrix}$ $C = \begin{bmatrix} -1 & 0 & -4 \\ 3 & -2 & 1 \end{bmatrix}$

*1. Evaluate each of the following.

a. $AB + C$

b. $3AC - B$

_____ _____

*2. Solve the system of equations.

$3x - y + 2z = -3$
$-x + 2y - z = 2$
$2x - 3y + z = -1$

$x =$ _____ $y =$ _____ $z =$ _____

*3. Determine whether A and B are inverse matrices. Explain.

$A = \begin{bmatrix} 1 & 2 \\ 1 & 3 \end{bmatrix}, B = \begin{bmatrix} 3 & -2 \\ -1 & 1 \end{bmatrix}$

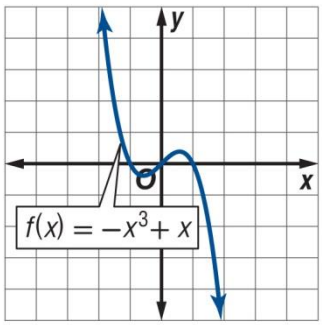
4. Find the value of the variables: $\begin{bmatrix} 3x^2 + x & -2 \\ y^2 & 16 \end{bmatrix} = \begin{bmatrix} 4 & -z + 4 \\ 36 & 16 \end{bmatrix}$.

*5. Sanjay was in Canada this summer. He made phone calls from within Canada as well as to the US and Mexico while he was there. The charges are 28¢/min within Canada, 30¢/min to the U.S., and 84¢/min to Mexico. Sanjay's total bill for the month was $90.96. He talked twice as long to Mexico as he did to the U.S. The total number of minutes spent talking within Canada and to Mexico was 122. How much money did Sanjay have to spend on phone calls to the US?

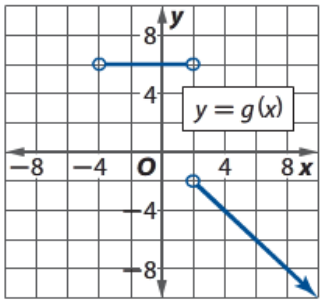
Chapter 1:

1. Using the functions below, find the following domain, range and interval(s) of inc, dec, constant:

a.



b.

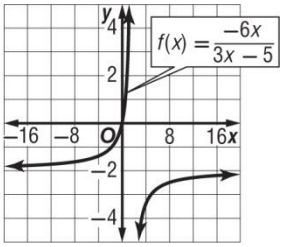


2. Test each of the following functions for symmetry with respect to the *x*-axis, *y*-axis, and origin. Determine whether the function is even, odd, or neither.

a. $y = x^4 - 8x^2$ b. $y = 2x + 8$ c. $y = x^3$ d. $xy = 12$

3. Describe the end behavior of each function using limit notation.

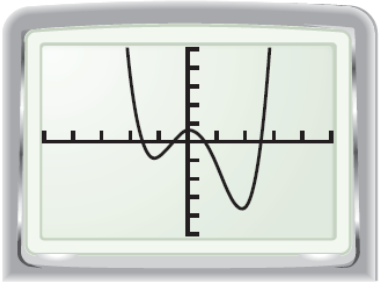
a.



b. $h(x) = -4x^6 - 5x^2 + 2$ c. $f(x) = 2x(x + 3)^2(x - 5)$

4. Approximate the following from the graph.
(The interval for both the x and y axis are by one)

a. Domain
b. Range
c. Roots (x-intercept(s))
d. Y-intercept
e. Local maximum, if any.
f. Local minimum, if any.



5. Write the function whose graph is the graph of $y = x^3$, but is stretched vertically by a factor of 2, shifted to the left 1 unit, and shifted up 3 units.

6. Given $f(x) = 2x^2 - 8$ and $g(x) = -x + 9$, find each of the following.

a. $(f \circ g)(x) =$_____ b. $(g \circ f)(1) =$_____ c. $(f \circ f)(-2) =$_____

7. A small stone is thrown into still water and creates a circular wave. The radius *r* of the water wave increases at the rate of 2 cm per second.
a) Find an expression for the radius *r* in terms of time *t* (in seconds) after the stone was thrown.

b) If *A* is the area of the water wave, find $(A \circ r)(t)$. What does the composition $(A \circ r)(t)$ represent?

c) Find the area *A* of the water wave after 5 seconds.

8. Find $(f + g)(x)$, $\left(\frac{g}{f}\right)(x)$, and $[f \circ g](x)$ for the functions $f(x) = \frac{3}{x+5}$ and $g(x) = 2x$. State the domain of each new function.

a. $(f + g)(x)$ = _____ Domain: _____

b. $\left(\frac{g}{f}\right)(x)$ = _____ Domain: _____

c. $[f \circ g](x)$ = _____ Domain: _____

9. Find two functions *f* and *g* such that $h(x) = [f \circ g](x)$ for $h(x) = 2(x-3)^4 + 1$. Neither function may be the identity function $f(x) = x$.

$f(x) =$ _____ $g(x) =$ _____

10. Prove the following functions are inverses. $f(x) = \frac{1}{7}x - \frac{3}{7}$ and g(x) = 7x + 3

11. Determine the equation for the inverse of the functions. If the function is not invertible, restrict the domain and then find the inverse. State the domain of the inverse function.

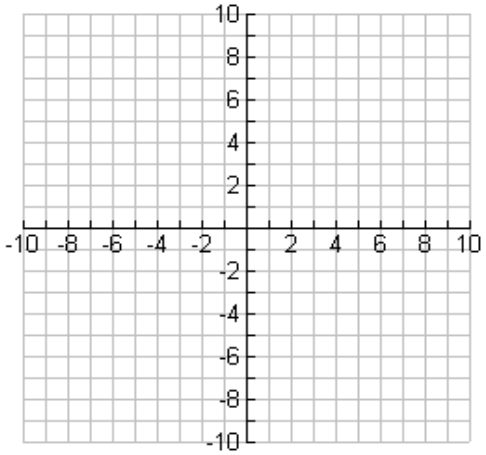
a. $g(x) = 2x - 6$ b. $f(x) = (x-1)^3 + 1$ c. $f(x) = (x - 3)^2 - 2$

Chapter 2:

1. For the function $f(x) = x^4 - x^3 - 6x^2$
   a. Determine the end behavior of the graph.

   b. Determine the zeros and state the multiplicity of any repeated zeros

   c. Use this information to sketch a graph of the function.



2. Use long division to divide $(2x^4 + 5x^3 - 5x^2 + 3x - 18) \div (2x - 1)$.

3. Use synthetic division to divide $(x^3 - 8x^2 - 15) \div (x - 1)$.

4. Determine the remainder when $(4x^4 - 8x^3 + 12x^2 - 6x + 12)$ is divided by $(x + 1)$.

5. Write the function $h(x) = x^4 - 3x^3 + 6x^2 - 12x + 8$

a) Find the possible rational zeros of *h(x).*

b) Find all the zeros of *h(x)*. (4 pts)

c) Write h(x) as the product of linear and irreducible quadratic factors.

d) Write *h(x)* as the product of linear factors.

6. Write a polynomial function in standard form with a leading coefficient of one with the following zeros: x = -1 and x = (2 + i)

7. Solve the inequality: $\dfrac{(x-3)(x+2)}{(x-1)} \leq 0$

8. For each of the following:
   i. Determine the domain of the function.
   ii. Determine the *x* and *y* intercepts.
   iii. Determine the vertical asymptote(s).
   iv. State, if any, any horizontal or oblique asymptote(s).

   a. $f(x) = \dfrac{4x}{x+1}$ b. $f(x) = \dfrac{x^2+5x+6}{x+3}$

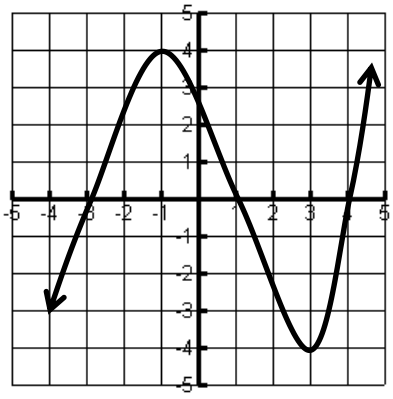
9. Determine the equations of the asymptotes and/or holes for the following functions:

   a. $f(x) = \dfrac{2x^3 + 7x^2 - 4}{x^2 + 2x - 3}$ b. $g(x) = \dfrac{x+2}{x^2 + 2x - 3}$

   c. $k(x) = \dfrac{2x^2 + 5x - 1}{5x^2}$ d. $h(x) = \dfrac{x^2 + 5x - 6}{2x^2 - 5x + 3}$

10. Approximate the following from the graph.
(The interval for both the x and y axis are by one)

a. Domain
b. Range
c. X-intercepts
d. Y-intercepts
e. Local maximum:
f. Local minimum:
g. Absolute Maximum:
h. Absolute Minimum:
i. Increasing:
j. Decreasing:
k. End behavior:



11. Simplify the expressions.

a. $\frac{x^2-16}{9-x} \cdot \frac{x^2+x-90}{x^2+14x+40}$

b. $\frac{n+3}{n+2} \div \frac{n^2+2n-3}{(n-1)^2}$

c. $\frac{7x}{x+1} + \frac{8}{x-7}$

d. $\frac{4}{x+1} - \frac{2}{x+2}$

12. Solve the equation.

a. $\frac{1}{x} + \frac{3x+12}{x^2-5x} = \frac{7x-56}{x^2-5x}$

b. $\frac{1}{x-2} + \frac{1}{x^2-7x+10} = \frac{6}{x-2}$

c. $\frac{x+5}{x^2-2x} - 1 = \frac{1}{x^2-2x}$

d. $\frac{5}{x^3+5x^2} = \frac{5}{x+5} + \frac{1}{x^2}$

13. Solve the inequality.

a. $3x^3 - 8x^2 + 3x < -2$

b. $\frac{4}{x^2+x-6} \geq \frac{x}{x-2}$

*14. Solve: $x^4 + 5x^2 - 3x = 50$ (round to nearest Hundredth)

*15. Expand: $(2x + 3)^4$.

6.4 partial fractions:

*1. Find the partial fraction decomposition of each rational expression.

$\frac{x+1}{x^2+5x+6}$ b. $\frac{7x^2-6x-3}{x^3-x}$

<u>Chapter 3</u>

1. Re-write the following exponential statements as logarithmic statements.

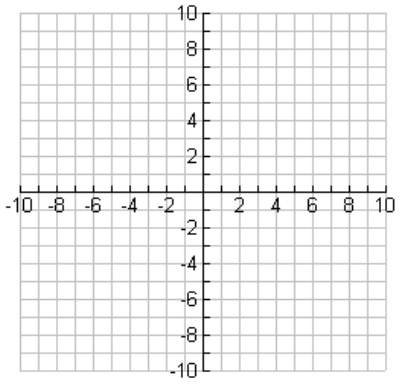
a. $t = 4^x$ b. $w = e^4$

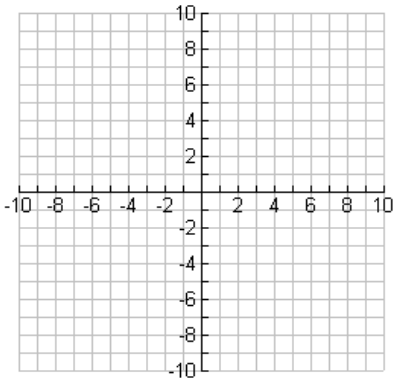
2. Re-write the following logarithmic statements as exponential statements.

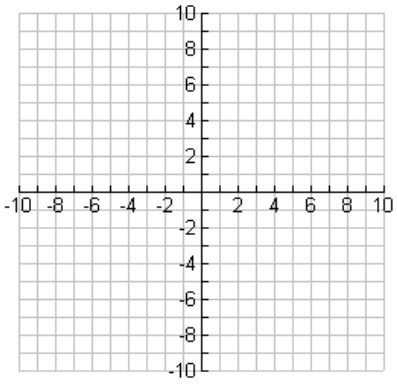
a. $b = \log_w j$ b. $v = \log \pi$

3. For each of the following functions, graph it and then describe its domain, range, intercepts, asymptotes, end behavior, and whether the function is increasing or decreasing.

a. $f(x) = 3^{x-2} + 4$ b. $g(x) = \log_4(x + 1) - 2$ c. $g(x) = -2\log_2(x - 4)$







4. What is final balance of an $800 invested in an account that pays 12% compounded quarterly for 7 years?

5. An initial investment of $1,300 became $2,500 after 10 years of earning at a continuously compounding rate. What was the rate of return?

6. How long must $20,000 be invested at a 9% rate compounding semi-annually in order to become $40,000?

7. When infected with Virus D a population of ants falls to 40% of its initial population after 18 hours. How long until there is only 20% left?

8. Carbon-14 has a half-life of 5730 years. Consider a sample of fossilized wood that when alive would have contained an initial amount of 24g of C-14. It now contains 1.5g. How old is the sample?

9. Evaluate each expression:

a. $\frac{\log_5 625}{\log_5 125}$ b. $\log_8 \frac{1}{64}$ c. log. 001 d. $8\log_4 \sqrt[3]{64}$ e. d. $2^{3\log_2 3}$

f. $\log_3 \sqrt[7]{27}$ g. $4\ln e^3 - 2\ln e^{-2}$ h. $\log 1$ i. $\log\left(\frac{1}{1000}\right) + 2\log 100$

10. Expand each expression:

a. $\log_2 \frac{3g^2p^{-3}}{m^5g^{.5}}$ b. $\log b^{-3}x^2w^{-5}$

11. Condense each expression:

a. $\ln 12 + \ln b - 4\ln d$ b. $\frac{1}{2}\log_5(b-2a) - \frac{1}{3}\log_5(2c-d)$

12. Solve each expression:

a. $\log_3(x^3 + 25) = \log_3 52$

b. $10^{5x-6} = 100^{2x+1}$

c. $\log_7(5x - 7) = 3$

d. $\log_9 2x = \log_9 196 - \log_9 2x$

e. $325 + 6\log_4 x = 349$

f. $7e^{3x-2} - 10 = 39$

g. $6^{4x+2} = 15^{x+1}$

h. $e^{2x} + 10e^x - 24 = 0$