Math 1301 - Test #3 Sample Name: Answer Sheet

Date: 4-23-13 **Spring 2013** **Student ID:** ____________

1a. Write the following expression as an imaginary number: $\sqrt{-49} = \boxed{7i}$

1b. Perform the operation and write the answer in the $a + bi$ form.

$(2 - i) - (9 - \sqrt{-25}) = \boxed{-7+4i}$

$= (2-i)-(9-5i)$

$= 2-i-9+5i = -7+4i$

1c. Perform the operation and write the answer in the $a + bi$ form.

$(2 - i)(9 - 5i) = \boxed{13-19i}$

$= 18-10i-9i+5i^2 = 18-19i-5 = 13-19i$

1d. Perform the operation and write the answer in the $a + bi$ form.

$(2 - i)^2 = \boxed{3-4i}$

$= (2-i)(2-i) = 4-2i-2i+i^2 = 4-4i-1 = 3-4i$

2. Solve the following equation by using the Quadratic Formula. Find all solutions, both real and imaginary (i.e. complex): $x^2 - 5x + 10 = 0$ $a=1,\ b=-5,\ c=10$

$$X = \frac{-(-5) \pm \sqrt{(-5)^2-4(1)(10)}}{2(1)} = \frac{5 \pm \sqrt{25-40}}{2} = \frac{5 \pm \sqrt{-15}}{2}$$

$$= \frac{5 \pm \sqrt{(-1)(15)}}{2} = \frac{5 \pm i\sqrt{15}}{2}$$

3. Solve the following equation by using the Quadratic Formula. Find all solutions, both real and imaginary (i.e. complex): $3x^2 + 8 = 4x$

$3x^2-4x+8=0$ $a=3,\ b=-4,\ c=8$

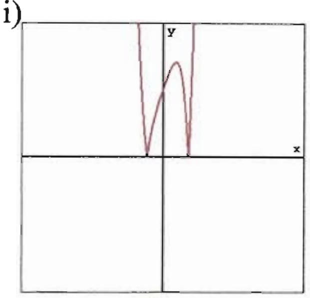
$$X = \frac{-(-4) \pm \sqrt{(-4)^2-4(3)(8)}}{2(3)} = \frac{4 \pm \sqrt{16-96}}{6} = \frac{4 \pm \sqrt{-80}}{6}$$

$$= \frac{4 \pm \sqrt{(-1)(16)(5)}}{6} = \frac{4 \pm 4i\sqrt{5}}{6} = \frac{2(2 \pm 2i\sqrt{5})}{6}$$

$$= \frac{2 \pm i\sqrt{5}}{3}$$

4. Which of the following graphs could be a polynomial function? Circle the correct answer.

i)



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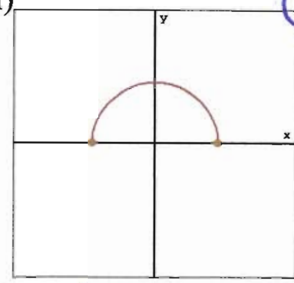

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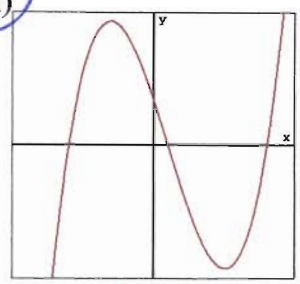

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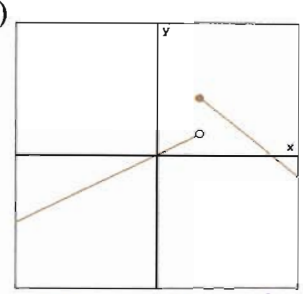


Graph must be smooth, unbroken curve with domain $= (-\infty, \infty)$

5. Circle the functions shown here that are polynomials.

5a. $f(x) = 3 + \sqrt{x^4 - 2x - 1}$

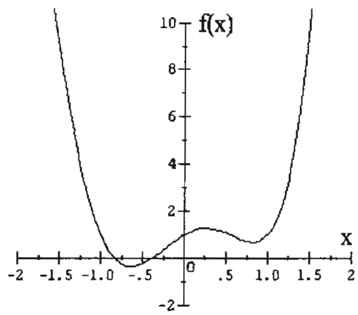
5b. $g(z) = 3 - z^2 - 2z^4$

5c. $h(a) = \frac{2}{5}a^3 - a^2 + a\sqrt{3}$

5d. $p(x) = \frac{2}{5x} - 3x + 1$

5e. $q(x) = (2x^2 - 4)(x^3 + 2x) = 2x^5 + 4x^3 - 4x^3 - 8x = 2x^5 - 8x$

6. Study the graph of the polynomial function f shown here.



6a. How many x-intercepts are shown? 2

6b. How many turning points are shown? 3

6c. What is the smallest degree this function could have? 4

6d. Estimate the coordinates of the middle turning point of f. $(0.25, 1.2)$

6e. What is the domain of f? domain $=$ $(-\infty, \infty)$

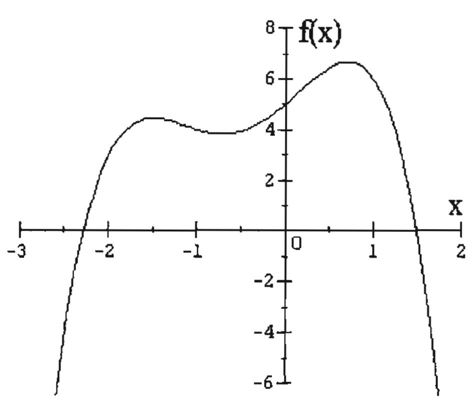
6f. The function f is decreasing on which interval? Circle your answer.

i. $[1.2, 0.7]$ **ii.** $(-\infty, -0.5]$ **iii.** $[-0.7, 0.25] \cup [0.8, \infty)$ **iv.** $(-\infty, -0.7] \cup [0.25, 0.8]$

7. Consider the graph of the polynomial function

$f(x) = -x^4 - 2x^3 + x^2 + 3x + 5$

shown here.



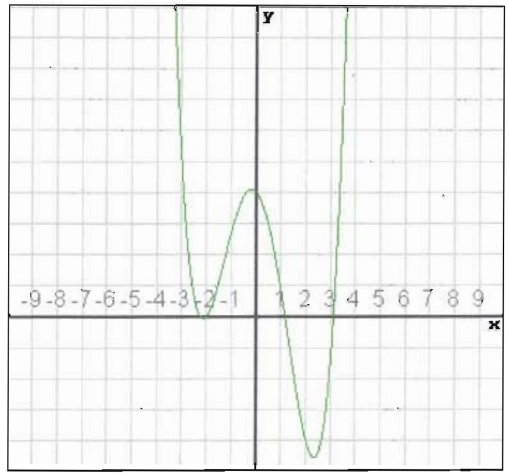
7a. Find the degree of the function f. 4

7b. Find the leading coefficient of the function f. -1

7c. Estimate the interval on which the function f is increasing. Write your answer using interval notation.

$(-\infty, -1.5] \cup [-0.7, 0.8]$

8. Study the graph of the polynomial function f given here.



8a. *True* or *False*: The leading coefficient is positive. Circle your answer.

8b. What is the minimum of the function f ? -4.5

8c. What is the maximum of the function f ? none

8d. What are the valley turning points of the function f ? $(-2,0), (2.4, -4.5)$

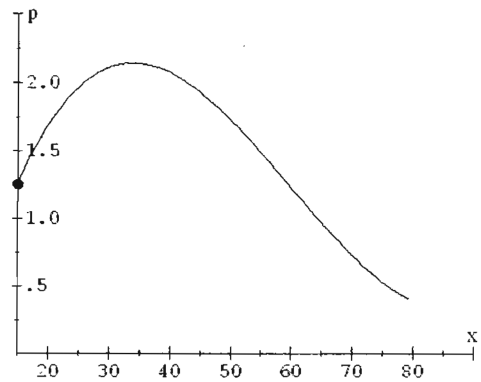
8e. What are the peak turning points of the function f ? $(-0.1, 4.1)$

8f. What is the range of f? Write the answer in interval notation. $[-4.5, \infty)$

9. Read the paragraph through once and then fill in the blanks. Consider the polynomial function $h(x) = 0.1x^5 - 2x^2 - 3x + 4$. The degree of the polynomial function is ____5____ and the lead coefficient of the polynomial function is ____0.1____ (positive/negative). The end behavior of the graph of h is that it __________ (falls/rises) on the far left and it ________ (falls/rises) on the far right The maximum number of x-intercepts of this function is ____5____. The maximum number of turning points of this function is ____4____.

10. Read the paragraph through once and then fill in the blanks. Consider the polynomial function $f(x) = x^3 - x^6 + 1$. The degree of the polynomial function is ____6____ and the lead coefficient of the polynomial function is ____-1____ (positive/negative). The end behavior of the graph of f is that it __________ (falls/rises) on the far left and it ________ (falls/rises) on the far right. The maximum number of x-intercepts of this function is ____6____. The maximum number of turning points of this function is ____5____.

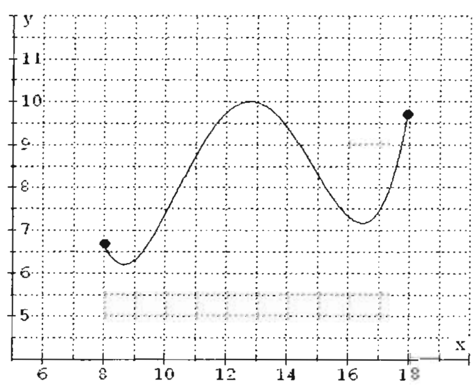
11. The following function approximately depicts the percentage of the population p of the U.S. in 2008 who were age x, for ages 15 and above.



Share of Population as a Function of Age

Estimate the age interval with a rising share of the population. [15, 35]

12. The U6 unemployment rate y is a broad measure of the percentage of adults in the U.S. who cannot find a job. The following function approximately depicts the U6 unemployment rate x years from 1990.



Unemployment as a Function of Elapsed Years

12a. Estimate the coordinates of the turning points of this function. (8.8, 6.2), (12.9, 10), (16.5, 7.2)

12b. Interpret your answer(s) from part a in a practical context.

The U6 unemployment rate reached a relative peak (maximum) in 2002. The rate reached relative valleys (minima) in 1998 and 2006.

13. *True* or *False*: The function g shown here is exponential. Circle your answer.

x	0	1	2	3
$g(x)$	2	2.4	2.88	3.40

.4 .48 .52

$\frac{.4}{2} \times 100\% = 20\%$

$\frac{.48}{2.4} \times 100\% = 20\%$

$\frac{.52}{2.88} \times 100\% = 18\%$

14. Which of the following statements are true for $f(x) = 2^x$? Circle all that are correct.
i. f is a polynomial function of degree 4.
ii. f has two turning points.
iii. f is an exponential function.
iv. $(1, 0)$ is on the graph of f.
v. The domain is all real numbers.
vi. No x-intercepts.

15. Let $f(x) = 16(4)^x$.

15a. Evaluate $f(2) =$ $\boxed{16(4)^2 = 16(16)} = 256$

15b. Evaluate $f(0) =$ $\boxed{16(4)^0 = 16 \cdot 1} = 16$

15c. Evaluate $f(-2) =$ $\boxed{16(4)^{-2} = 16 \cdot} \frac{1}{16} = 1$

15d. Evaluate $f(\frac{1}{2}) =$ $\boxed{16(4)^{1/2} = 16(}\sqrt{4}) = 32$

15e. What is the base of this function? Circle your answer.

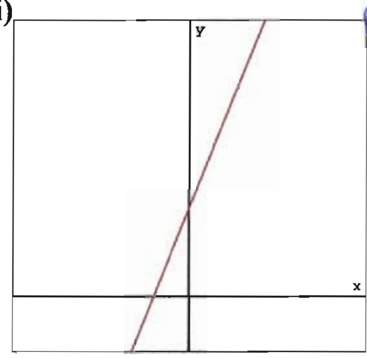
i. 0 **ii.** 4 **iii.** 16 **iv.** 64 **v.** 1

15f. What is the initial value of this function? Circle your answer.

i. 0 **ii.** 4 **iii.** 16 **iv.** 64 **v.** 1

15g. Which of the following graphs *could* be the graph of the function f? Circle your answer.

i)



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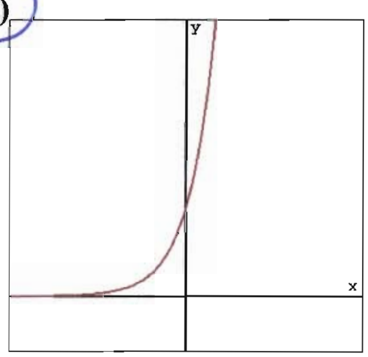

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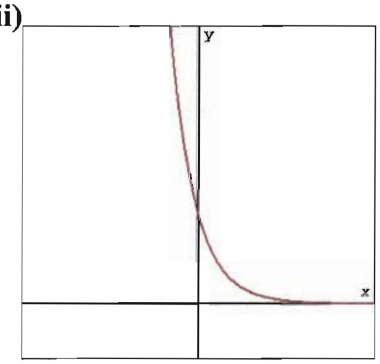


16. Daily world oil demand is currently projected to rise at a rate of 1.6% each year from 2005 to 2030. Let $P(t)$ be the daily demand for oil, t years after 2005. Why is it appropriate to assume that P is an exponential function? Briefly explain.

Because daily world oil demand is increasing at a steady percentage rate each year.

17. The following function can be used to determine the remaining amount y (in mg) of a sample of the radioactive substance kryptonite, t years after the sample was gathered.

$$y = k(t) = 10(0.8)^t$$

17a. Find the y-intercept of this function and interpret the meaning.

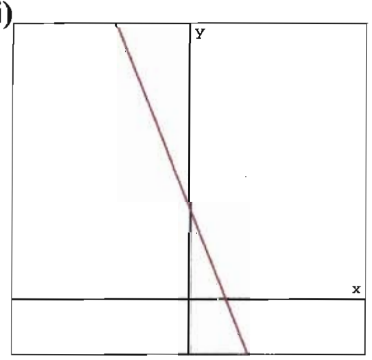
$y\text{-int.} = k(0) = 10(0.8)^0 = 10(1) = 10$
The initial size of the sample was 10 mg.

17b. Evaluate $k(2)$ interpret the meaning.

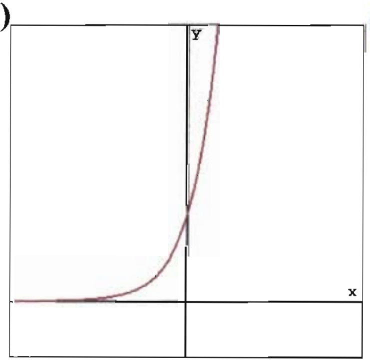
$k(2) = 10(0.8)^2 = 10(0.64) = 6.4$
The size of the sample is 6.4 mg after 2 years.

17c. Which of the following graphs *could* be the graph of the function k? Circle your answer.

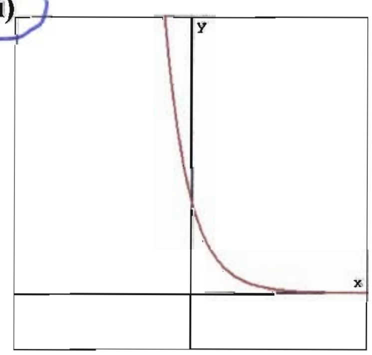
i)



ii)



iii)



18. Evaluate the following logarithmic functions.

18a. $\log_4 16 =$ 2 b/c $4^2 = 16$

18b. $\log_3 81 =$ 4 b/c $3^4 = 81$

18c. $\log_{25} 5 =$ 1/2 b/c $25^{1/2} = \sqrt{25} = 5$

18d. $\log_8 \frac{1}{8} =$ -1 b/c $8^{-1} = 1/8$

18e. $\ln 1 =$ 0 b/c $e^0 = 1$

18f. $\log 1000 =$ 3 b/c $10^3 = 1000$

18g. $\ln 10 \overset{\sim}{=}$ 2.30 b/c $e^{2.30} \sim 10$

18h. $\log 2 =$ 0.30 b/c $10^{0.30} \sim 2$

19. Write the following equations in logarithmic form:

19a. $6^3 = 216$

$\log_6 216 = 3$

19b. $10^{-2} = \frac{1}{100}$

$\log \frac{1}{100} = -2$

20. Write the following equations in exponential form:

20a. $\log_2 5 = x$

$2^x = 5$

20b. $\ln x = 1.7$

$e^{1.7} = x$

21. Solve: $e^x = 25$

$\ln e^x = \ln 25$

$x \cdot \ln e = \ln 25$

$x \cdot 1 = \ln 25$

$x = \ln 25 \sim 3.22$

22. Solve: $10^{2x-3} = 15$

$\log 10^{2x-3} = \log 15$

$(2x-3) \cdot \log 10 = \log 15$

$(2x-3) \cdot 1 = \log 15$

$2x - 3 = \log 15$

$2x = 3 + \log 15$

$x = \frac{3 + \log 15}{2} \sim 2.09$