

Part I: 1-10: multiple choice (3 pts ea.).  
problem select the best answer or response from the choices listed.

Directions: Do all problems. For each

1. Find the slope of the line passing through the points (2, 1) and (5, -1). 1. \_\_\_\_  
(A)  $-3/2$                       (B)  $-3/4$                       (C)  $-2/3$                       (D)  $2/3$                       (E)  $-4/3$
  
2. Find the y-intercept of the line that passes through the point (3, 2) with slope 2. 2. \_\_\_\_  
(A)  $-1$                       (B)  $1/3$                       (C)  $2$                       (D)  $-4$                       (E)  $-3$
  
3. What are the coordinates of the vertex of the parabola whose equation is  $y = x^2 - 10x + 26$  3. \_\_\_\_  
(A) (5, 1)                      (B) (5, 51)                      (C) (-5, 51)                      (D) (-5, -1)                      (E) (-5, 1)
  
4. What are the x-intercepts of the quadratic equation  $y - 12 = 2x^2 - 10x - 4$ ? 4. \_\_\_\_  
(A)  $\{-4, -1\}$                       (B)  $\{4, 1\}$                       (C)  $\{1, 7\}$                       (D)  $\{-1, -7\}$                       (E)  $\{-2, 12\}$
  
5. The points (2, 4) and (8, 2) lie on the curve  $y = a \cdot b^x$ . What is the value of the constant  $b$ ? 5. \_\_\_\_  
(A) 1.122                      (B) 2                      (C) 8                      (D) 16                      (E) 0.891
  
6. Cesium-137 has a half-life of 30 years. If the initial amount is 4 grams, how much remains after 10 years? 6. \_\_\_\_  
(A)  $4.23 \times 10^{-10}$  grams                      (B) 3.00 grams                      (C) 1.33 grams                      (D) 3.17 grams                      (E) 1.58 grams
  
7. A population grows at 3.7 % per year. In how many years will the population double? 7. \_\_\_\_  
(A) 6.9                      (B) 18.7                      (C) 16.9                      (D) 9.6                      (E) 23.4

8. About how many more times intense is an earthquake with Richter magnitude 4.3 than an earthquake of Richter magnitude 4.0. Recall that Richter magnitude is calculated as

$$\text{Richter magnitude} = \log \frac{S}{S_0}, \quad \text{where } S_0 = \text{the magnitude of a 'standard' event}$$

8. \_\_\_\_

- (A) 0.3                      (B) 0.5                      (C) 1.995                      (D) 2.995                      (E) 3.333

9. What is the degree of the polynomial expression  $(x^2 + 2)^2(3x^2 + 3)(2x - 3)$ ?

9. \_\_\_\_

- (A) 7                      (B) 6                      (C) 5                      (D) 4                      (E) 3

10. When  $x^3 + 6x^2 + 11x - 8$  is divided by  $x + 2$  the remainder is

10. \_\_\_\_

- (A) -4                      (B) 4                      (C) 2                      (D) -2                      (E) -14                      (F) -16

Part II. Short answer. (3 pts each unless otherwise marked)

11. Find a number  $x$  correct to three decimals such that:  $5^{\sqrt{x}} = 20$ .

12. Solve for  $x$  correct to three decimals places:  $\log_4(3x + 1) = 2$

13. Solve for  $x$  correct to three decimals places:  $x^{2/3} = 2.89$

14. Solve for  $x$  correct to three decimals places:  $\log_3 36 = x$ .

15. Evaluate the following expression correct to three decimals places:  $(3^{-2} + 4^0)^{-1}$ .

16. Solve for  $x$  correct to three decimals places:  $\log_x 2 = 5$ .

17. Find all values for  $x$ :  $\log_6 x + \log_6 (x - 5) = 2$

18. Find all real solutions to  $e^{2x} - e^x = 6$ .

19. Find all real solutions to  $x - 3\sqrt{x} = 10$

20. Find all real solutions to  $\frac{1 + \ln x}{2 + \ln x} = 0.9$

21. Find the radius of the circle whose equation is

$$x^2 - 6x + y^2 + 10y = 2$$

22. In the figure below, the line shown passes through the center of the circle.

A) Find the radius.

B) Find the center.

C) Give the equation of the circle.

23. The radioactive decay rate of Ne-10 is 34.66% per second. What is its half-life?

Match the following rational functions to the statements 23 - 26 below. A statement may match none, one, or several of the given functions, give **all** that apply. You are not required to draw any graphs. (2 pts each)

$$(a) \ y = \frac{x^2 + 1}{2x(1 - x^2)} \quad (b) \ y = \frac{3x}{x + 1} \quad (c) \ y = \frac{x - 2}{(x - 4)(x - 1)} \quad (d) \ y = \frac{x^2 - 5x + 6}{x^2 - x - 2}$$

24. This function(s) has no real zeros ( $x$ -intercepts).

25. The graph of this function(s) has a vertical asymptote at  $x = -1$ .

26. This graph has a horizontal asymptote at  $y = 1$ .

27. The  $y$ -intercept of this function is the point  $(0, \frac{1}{2})$ .

Part III. Do all of the following three problems. Show **all** steps! I must be able to recreate the logic of your work. (6 pts each)

28. The balance of a bank account begins at \$32,000 and earns 4.8% interest per year compounded monthly. When will the value of the account reach \$60,000? (How many years?) Show all work!

29. Use your calculator to graph the polynomial  $p(x) = x^3 - 3x^2 - x + 3$ . Sketch  $p(x)$  below, indicating the zeros and the write  $p(x)$  in factored form.

30. The height, in feet, of a rocket  $t$  seconds after launch is given by  $h = -16t^2 + 160t$ .

A) Sketch a graph of this function on a set of axes with the  $t$ -intercepts clearly marked with their correct value.

B) How long does the rocket stay in the air.

B. \_\_\_\_\_ seconds

C) What is the maximum height attained by the rocket and at what time  $t$  does the maximum occur?

C. Maximum height is \_\_\_\_\_ feet

which occurs at  $t =$  \_\_\_\_\_ seconds.