

**Math 101: College Algebra**  
**Spring 2018**  
**Final Exam**  
**Time Limit: 3 Hours**

**Print Name:** \_\_\_\_\_

**Signature:** \_\_\_\_\_

No electronic devices or calculators allowed. Show all of your work on this test paper. Put answers in the blanks provided. This exam has 39 questions worth 200 points. The point values of each question are shown in the left margin in [brackets].

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**PART I: SHORT ANSWER QUESTIONS**

- [5] 1. Factor completely. If the polynomial cannot be factored, say it is prime.

$$y^3 + 27$$

1. \_\_\_\_\_

- [5] 2. Factor completely. If the polynomial cannot be factored, say it is prime.

$$8t^2 - 6t - 9$$

2. \_\_\_\_\_

- [6] 3. Perform the indicated operation and simplify. Leave answer in factored form.

$$\frac{8}{x+1} + \frac{x}{x^2-1}$$

3. \_\_\_\_\_

[6] 4. Perform the indicated operation and simplify. Leave answer in factored form.

$$\frac{7b - 7}{b} \cdot \frac{9b^2}{8 - 8b}$$

4. \_\_\_\_\_

[8] 5. Perform the indicated operation and simplify. Leave answer in factored form.

$$\frac{1 + \frac{1}{u}}{7 - \frac{2}{u}}$$

5. \_\_\_\_\_

[6] 6. Simplify the expression. Write your answer using only positive exponents.

$$\left(\frac{rt^{-3}}{r^{-4}t}\right)^{-4}$$

6. \_\_\_\_\_

[6] 7. Solve the equation for  $n$ :

$$I = \frac{nE}{nr + R}$$

7. \_\_\_\_\_

[5] 8. Simplify the expression completely. Assume that all variables are positive.

$$\sqrt{180k^7q^8}$$

8. \_\_\_\_\_

[6] 9. Simplify the expression. Write your answer using only positive exponents.

$$\frac{x^{2/3}}{(x^3)^{5/3}}$$

9. \_\_\_\_\_

[6] 10. Find all real solutions to the equation. You must show work to support your answer.

$$(k - 5)^2 = 19$$

10. \_\_\_\_\_

[6] 11. Find all real solutions to the equation. You must show work to support your answer.

$$\sqrt{3w + 22} = w + 6$$

11. \_\_\_\_\_

[6] 12. Find all real solutions to the equation. You must show work to support your answer.

$$2x^3 - 5x^2 - 2x + 5 = 0$$

12. \_\_\_\_\_

[8] 13. Complete the square to find the radius and the center of the circle with equation

$$x^2 + y^2 - 6x + 8y = 4$$

Radius: \_\_\_\_\_ Center: \_\_\_\_\_

[6] 14. Solve the system of linear equations:

$$\begin{cases} 3x + 15y = 0 \\ x - 5y = 10 \end{cases}$$

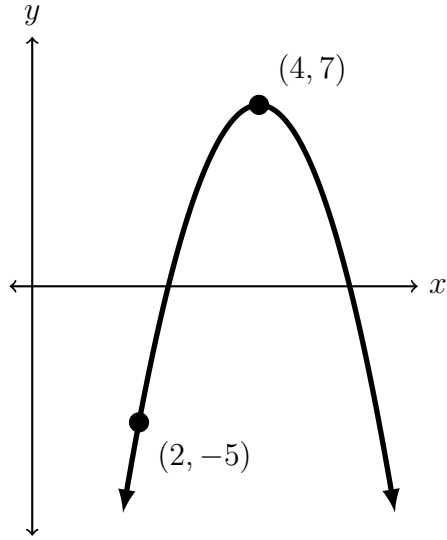
14. \_\_\_\_\_

[6] 15. Solve the inequality and write your answer using interval notation. If no solution exists, write “no solution.”

$$(x - 5)(x + 10) < 0$$

15. \_\_\_\_\_

[6] 16. Find the equation of the quadratic function  $f(x)$  whose graph is shown below.



16. \_\_\_\_\_

[6] 17. Solve the inequality and write your answer using interval notation. If no solution exists, write “no solution.”

$$-10 + 8x + 12 \geq 7x - 7$$

17. \_\_\_\_\_

[6] 18. Solve the inequality and write your answer using inequality notation. If no solution exists, write “no solution.”

$$|2x - 5| - 3 \leq 1$$

18. \_\_\_\_\_

19. On the problems below you must show work which supports your answer to receive credit.

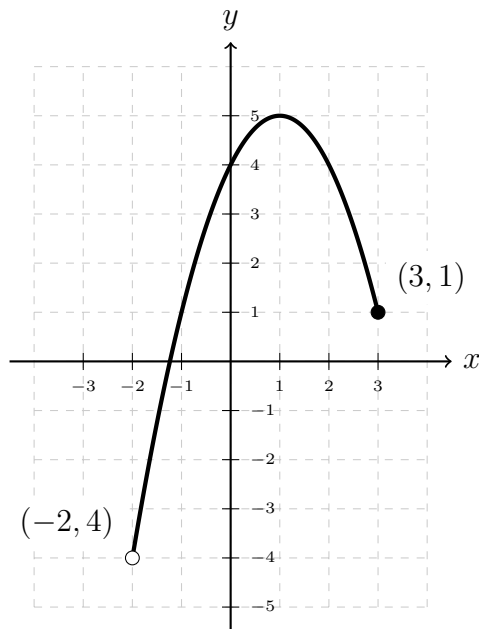
[2] (a) For the function  $f(x) = 3x + 5$ , find  $f(x + h)$  and simplify.

(a) \_\_\_\_\_

[5] (b) For the function  $f(x) = 3x + 5$ , find the difference quotient  $\frac{f(x + h) - f(x)}{h}$  and simplify.

(b) \_\_\_\_\_

[8] 20. Use the graph of the function  $f$  shown below to answer the following questions.



(a) Find  $f(2)$ .

\_\_\_\_\_

(b) What is the domain of  $f$ ?

\_\_\_\_\_

(c) What is the range of  $f$ ?

\_\_\_\_\_

(d) When is  $f(x) = 1$ ?

\_\_\_\_\_

**PART II: MULTIPLE CHOICE QUESTIONS.** Each question is worth 4 points. Write the letter corresponding to your answer in each blank.

- [4] 21. \_\_\_\_\_ Write in radical form:  $m^{8/3}$   
 A.  $\sqrt[8]{m^3}$     B.  $(\sqrt{m^8})^3$     C.  $(\sqrt{m^3})^8$     D.  $\sqrt[3]{m^8}$     E. None of these
- [4] 22. \_\_\_\_\_ Find any horizontal asymptote(s) of  $f(x) = \frac{5x(x-4)}{(x-3)(x+3)}$ .  
 A.  $y = 0$     B.  $y = 5$     C.  $x = 4, x = -1$     D.  $x = 3, x = -3$     E. None of these.
- [4] 23. \_\_\_\_\_ Find any vertical asymptote(s) of  $f(x) = \frac{5x(x-4)}{(x-3)(x+3)}$ .  
 A.  $x = 3, x = -3$     B.  $x = -3, x = 0, x = 3, x = 4$     C.  $y = 5$     D.  $x = 0, x = 4$   
 E. None of these.
- [4] 24. \_\_\_\_\_ Simplify the expression and write using positive exponents:  $3k^{-2}$   
 A.  $\frac{-1}{6k}$     B.  $\frac{-9}{k^2}$     C.  $\frac{3}{k^2}$     D.  $\frac{1}{9k^2}$     E.  $-9k^2$
- [4] 25. \_\_\_\_\_ Rationalize the denominator and simplify:  $\frac{5}{8 - \sqrt{2}}$   
 A.  $\frac{40 + 5\sqrt{2}}{6}$     B.  $\frac{40 + 5\sqrt{2}}{62}$     C.  $\frac{40 - 5\sqrt{2}}{62}$     D.  $\frac{5}{8} - \frac{5}{\sqrt{2}}$
- [4] 26. \_\_\_\_\_ Find the product and simplify.  
 $(-3x^4y^4)(-4x^3y^2)$   
 A.  $12x^6y^7$     B.  $12x^7y^6$     C.  $12xy^6$     D.  $-7x^{12}y^6$
- [4] 27. \_\_\_\_\_ Convert the exponential expression  $x^{2/5} = 4$  to logarithmic form.  
 A.  $\log_x(4) = \frac{2}{5}$     B.  $\log_{2/5}(4) = x$     C.  $\log_x(\frac{2}{5}) = 4$     D.  $\log_4(x) = \frac{2}{5}$
- [4] 28. \_\_\_\_\_ Evaluate and simplify:  
 $-\left(\frac{36}{49}\right)^{-1/2}$   
 A.  $-\frac{6}{7}$     B.  $\frac{7}{6}$     C.  $\frac{18}{49}$     D.  $-\frac{7}{6}$     E.  $\frac{6}{7}$
- [4] 29. \_\_\_\_\_ Factor completely:  $15wx - 20wy - 25wz$   
 A.  $5w(3x - 4y - 5z)$     B.  $5(3wx - 4wy - 5wz)$     C.  $15w(x - 20y - 25z)$   
 D.  $5w(3x - 20wy - 25wz)$



[4] 30. \_\_\_\_\_ Find the slope of the line  $2x + 9y = -1$ .

A.  $m = -1$    B.  $m = -2/9$    C.  $m = 9/2$    D.  $m = 2$    E.  $m = 9$

[4] 31. \_\_\_\_\_ For the function  $f(x) = 2x - 3$ , find the inverse function  $f^{-1}(x)$ .

A.  $f^{-1}(x) = \frac{1}{2x-3}$    B.  $f^{-1}(x) = \frac{x+3}{2}$    C.  $f^{-1}(x) = \frac{x-3}{2}$    D.  $f^{-1}(x) = \frac{x}{2} + 3$

[4] 32. \_\_\_\_\_ Evaluate the logarithm:  $\log_9(81)$

A.  $-2$    B.  $2$    C.  $\frac{1}{9}$    D.  $9$    E. None of these.

[4] 33. \_\_\_\_\_ Solve for  $x$ :  $|5 - 4x| = 8$

A.  $x = -3/4, x = 3/4$    B.  $x = -3/4, x = 13/4$    C.  $x = -13/4, x = 3/4$   
D.  $x = -13/4, x = 13/4$

[4] 34. \_\_\_\_\_ Solve for  $x$ :  $3x^2 = 27$

A.  $x = -3, x = 3$    B.  $x = 3\sqrt{3}, x = -3\sqrt{3}$    C.  $x = 9$    D.  $x = \pm 9$

[4] 35. \_\_\_\_\_ Solve for  $t$ :  $3^{7t} = 27$

A.  $t = -1$    B.  $t = 2$    C.  $t = 0$    D.  $t = 9$    E. None of these.

[4] 36. \_\_\_\_\_ Find the distance between the two points. Simplify your answer.

$(-6, 4)$    and    $(4, 6)$

A.  $2\sqrt{26}$    B.  $8$    C.  $96\sqrt{6}$    D.  $96$

[4] 37. \_\_\_\_\_ Solve the inequality and write the answer in interval notation:

$$12 < -5s + 2 \leq 32$$

A.  $(-6, -2]$    B.  $[-6, -2)$    C.  $(2, 6]$    D.  $[2, 6)$

[4] 38. \_\_\_\_\_ Find the domain of the function  $f(x) = \sqrt{8 - 2x}$ .

A.  $(-\infty, 4) \cup (4, \infty)$    B.  $(4, \infty)$    C.  $(-\infty, 4)$    D.  $[4, \infty)$    E.  $(-\infty, 4]$

[4] 39. \_\_\_\_\_ Find the vertex of the quadratic function:

$$y = -2x^2 - 20x - 47$$

A.  $x = \frac{-10 \pm \sqrt{6}}{2}$    B.  $(3, -5)$    C.  $(0, -47)$    D.  $(-5, 3)$    E.  $(5, -3)$