

# Math III

## Cumulative Test – Spring 2017

Printed Name \_\_\_\_\_

I pledge to be honest and fair. I have neither given nor received unauthorized aid on this test or assignment.

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

This test is entirely calculator active.

All your work should be shown on the test however your final answers will be bubbled on a scantron sheet. If you use supplemental paper or graph paper, it must be submitted as well.



1. If  $f$  is an exponential function with  $f(0) = 4$  and  $f(2) = 16$ , then

a)  $f(x) = 2(4)^x$    b)  $f(x) = 4(2)^x$    c)  $f(x) = 4(16)^x$    d)  $f(x) = 4x^2$

2. Let  $f(x) = \frac{x-1}{x^2-9}$ . What are the asymptotes of the function?

a)  $y = 1, x = 3, x = -3$

b)  $x = 1, y = 3, y = -3$

c)  $y = 0, x = 3, x = -3$

d)  $x = 3, x = -3$

3. Solve  $\log_{25} x = \frac{1}{2}$ .

a)  $x = \frac{1}{25}$    b)  $x = \pm 5$    c)  $x = 5$    d)  $x = 50$

4. Nik invested \$16000 at 8% compounded quarterly for 6 years. Which formula is set up correctly?

a)  $16000(1 + 0.08)^{24}$

b)  $16000\left(1 + \frac{0.08}{4}\right)^6$

c)  $16000\left(1 + \frac{0.08}{4}\right)^{24}$

d)  $16000(1 + 0.08)^6$

5. Find the domain of  $\log_3(x + 2) - 1$ .

a.  $[-2, \infty)$

b.  $(-2, \infty)$

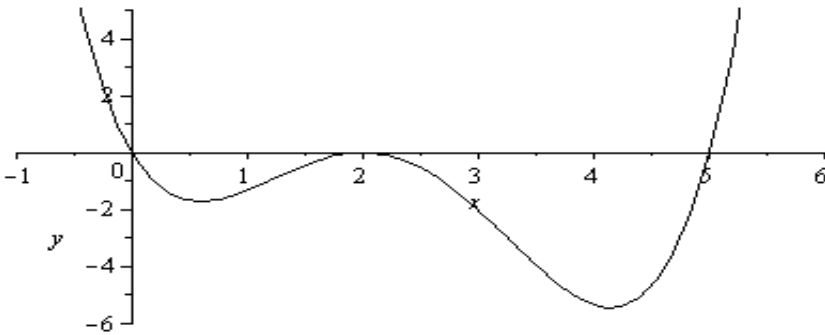
c.  $[-4, \infty)$

d.  $(-4, \infty)$

6. Which of the following is a polynomial with real coefficients that has  $2-i$  and  $2$  as zeros?

- a)  $(x + 2)(x - 2 - i)$
- b)  $(x - 2)(x + 2 + i)$
- c)  $(x - 2)(x^2 - 4x + 5)$
- d)  $(x - 2)(x^2 - 4x - 5)$

7. Which of the following could be an equation for the graph below?



- a)  $f(x) = -3x(x-2)^2(x-5)$
- b)  $f(x) = 3x(x-2)^2(x-5)$
- c)  $f(x) = -3x(x-2)(x-5)$
- d)  $f(x) = 3x^2(x-2)(x-5)$

8. What are the real solutions to the equation  $\log_4 x + \log_4(x+12) = 3$ ?

- a)  $x=12$
- b)  $x=-16, x=4$
- c)  $x=4$
- d) no real solutions

9. If the population of Holly Springs was 12,000 in 1995 and grew with a yearly exponential growth rate of 3.6%, how many people to the nearest thousand would be expected to live in Holly Springs in 2010?

- a) About 20,000 people.
- b) About  $2.6 \times 10^{18}$  people.
- c) About 5,000 people.
- d) About 16,000 people.

10. Given that  $\ln A = a$ ,  $\ln B = b$ , and  $\ln C = c$ , then  $\ln \frac{\sqrt{A}}{B^3 C^2} =$

a)  $\sqrt{a} - b^3 - c^2$

b)  $\sqrt{a} - b^3 c^2$

c)  $\frac{1}{2}a - 3b + 2c$

d)  $\frac{1}{2}a - 3b - 2c$

11. The radius of the circle with equation  $x^2 + 4x + y^2 - 6y = 36$  is

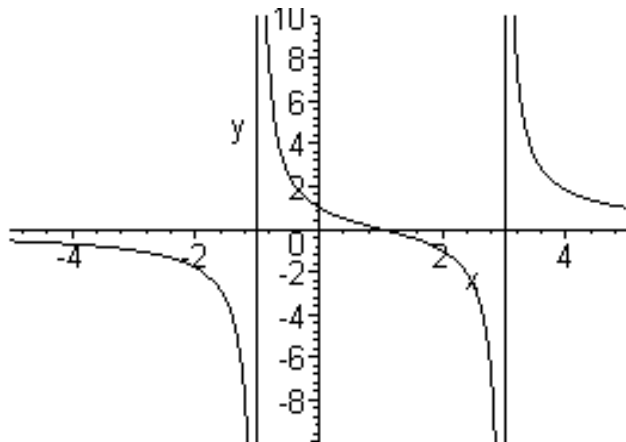
a) 36

b) 6

c) 7

d)  $\frac{\sqrt{40}}{9}$

12. If the graph of a rational function is given below, which equation would produce this graph?



a)  $f(x) = \frac{x}{x^2 - 4}$

b)  $f(x) = \frac{1}{(x+1)(x-3)}$

c)  $f(x) = \frac{x-1}{(x+1)(x-3)}$

d)  $f(x) = \frac{(x-1)^2}{(x+1)(x-3)}$

13. Simplify completely.  $\frac{x^2 - 10x - 24}{(2x^2 + 10x - 28)(x - 12)}$

a)  $\frac{1}{2(x+7)}$

b)  $2(x+7)$

c)  $\frac{x+2}{2x^2 + 10x - 28}$

d)  $\frac{1}{54x}$

14. Use the properties of logarithms to write the expression  $2 \log(x + 8) - 3 \log(x - 5)$  as a single logarithm.

a)  $6 \log(x + 8)(x - 5)$

b)  $\log \frac{2(x+8)}{3(x-5)}$

c)  $\log(x + 8)^2(x - 5)^3$

d)  $\log \frac{(x+8)^2}{(x-5)^3}$

15. Let  $f(x) = x^2 + 9$  Find the  $f^{-1}$ .

a)  $\sqrt{x-9}$

b)  $-\sqrt{x-9}$

c) both a and b

d)  $f(x)$  does not have an inverse.

16. What is the explicit rule for the sequence  $-7, -2, 3, 8, \dots$ ?

a)  $a_n = -3 + 5n$

b)  $a_n = -7(5)^{n-1}$

c)  $a_n = 5n - 12$

d)  $a_n = -7 + 5n$

17. Simplify this product completely.  $\frac{3x+9}{x^2+4x-21} \cdot \frac{x^2-49}{12}$ .

a)  $\frac{-7(x+3)}{4(4x-3)}$

b)  $\frac{x^2-49}{4(x+7)}$

c)  $\frac{(x+3)(x-7)}{4(x-3)}$

d)  $\frac{(x+3)(x+7)}{4(x-3)}$

18. A single cell amoeba doubles every 4 days. How long would it take one amoeba to produce a population of about 20,000 amoebae?

a) 9.2 days

b) 57.2 days

c) 14.3 days

d) 83.2 days

19. What is the period of  $y = 3 + \frac{1}{2} \cos(8x)$ ?

- a)  $4\pi$       b)  $2\pi$       c)  $\frac{\pi}{2}$       d)  $\frac{\pi}{4}$

20. Find the amplitude of the graph of  $y = 2 + 3 \cos(x - \pi)$ .

- a)  $a = 3$   
b)  $a = 2$   
c)  $a = \pi$   
d)  $a = 1$

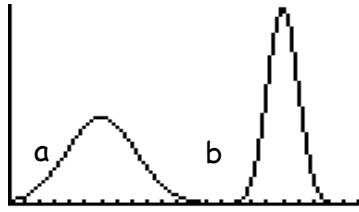
21. The price that manufacturers charge for an airplane part can be modeled by the function  $P(x) = 0.03x^3 - 2.2x^2 + 40x - 0.86$ . The number of parts sold can be modeled by the function  $N(x) = 100x^2 - 78x + 12$ . Give an expression in standard form for the income from the sale of these parts  $P(x) \cdot N(x)$ .

- a)  $3x^5 - 171.6x^3 + 480x - 0.86$   
b)  $3x^5 - 222.34x^4 + 4171.96x^3 - 3232.4x^2 + 547.08x - 10.32$   
c)  $3x^3 - 2.2x^2 - 38x + 11.14$   
d)  $0.03x^3 + 97.8x^2 - 38x + 11.14$

22. The expression  $(4 - 6i)^2$  is equivalent to

- a)  $-40$       b)  $-52 - 48i$       c)  $58$       d)  $-20 - 48i$

23. Consider the following two normal curves:



Which has the larger mean and which has the larger standard deviation?

- a) Larger mean a; larger standard deviation a
- b) Larger mean a; larger standard deviation b
- c) Larger mean b; larger standard deviation a
- d) Larger mean b; larger standard deviation b

24. Kyle found the quotient of  $(x^4 - 2x^3 + 9x - 52) \div (x - 3)$ . He got a remainder of 56. What remainder should Kyle have gotten?

- a) -16
- b) 2
- c) -160
- d) He is correct, the remainder is 56.

25. Find the value of  $x$ :  $81^{2x+1} = 27^{3x}$

- a.  $\frac{1}{4}$
- b.  $\frac{1}{2}$
- c. 4
- d. no real solutions

26. The income per household in a certain state is normally distributed with a mean \$11400 and a standard deviation of \$1650. The middle 95% of incomes are between what two values?

- a) \$3800 and \$13,050
- b) \$6450 and \$13,050
- c) \$8100 and \$14,700
- d) \$9750 and \$16,350

27. Environmental Protection Agency estimates for fuel economy for automobile models tested recently predicted a mean of 23.5 mpg and a standard deviation of 4.2 mpg for highway driving. The data is normally distributed. About what percent of cars should get between 27.7 mpg and 31.9 mpg?

- a) 13.5 %      b) 16%      c) 95%      d) 36.5%

28. Eugenia found a common denominator of  $5(x - 3)(x + 3)$  to add which of the following rational expressions?

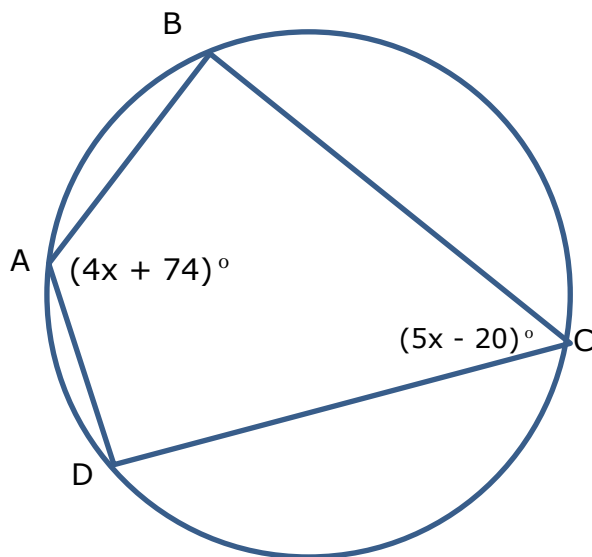
- a)  $\frac{2}{5x} + \frac{4x}{x^2 + 6x + 9}$   
 b)  $\frac{12}{x - 3} + \frac{4x}{5x + 15}$   
 c)  $\frac{5x}{9} + \frac{4x + 1}{x^2 - 5}$   
 d)  $\frac{12}{x - 5} + \frac{4x}{3x + 15}$

29. In rectangle ABCD the lengths of the sides are 16 cm and 63 cm. What is the length of a diagonal?

- a) 79 cm      b) 65 cm      c) 47 cm      d) 4225 cm

30. If  $m\widehat{BAD} = 100^\circ$ , find the value for  $\angle BAD$ ?

- a)  $50^\circ$       b)  $14^\circ$       c)  $100^\circ$       d)  $130^\circ$



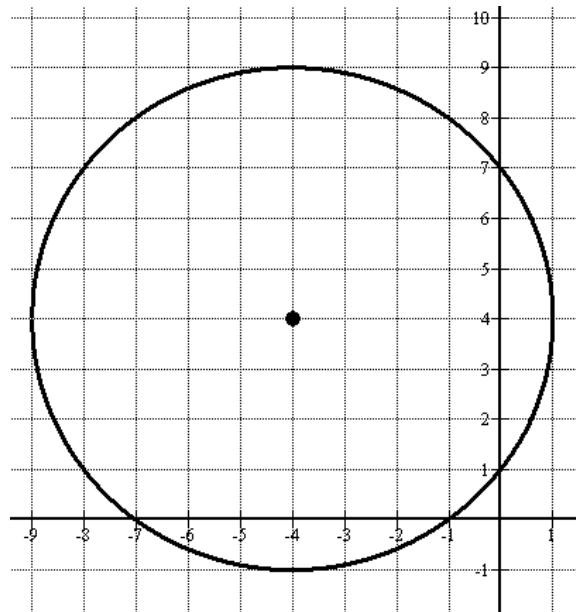


31. Find the equation of the parabola with focus at (5, 9) and directrix at  $y = 3$ .

- a)  $y = 2(x - 5)^2 + 6$
- b)  $y = 4(x - 5)^2 + 6$
- c)  $y = \frac{1}{4}(x - 5)^2 + 6$
- d)  $y = \frac{1}{12}(x - 5)^2 + 6$

32. Find the equation of the circle shown.

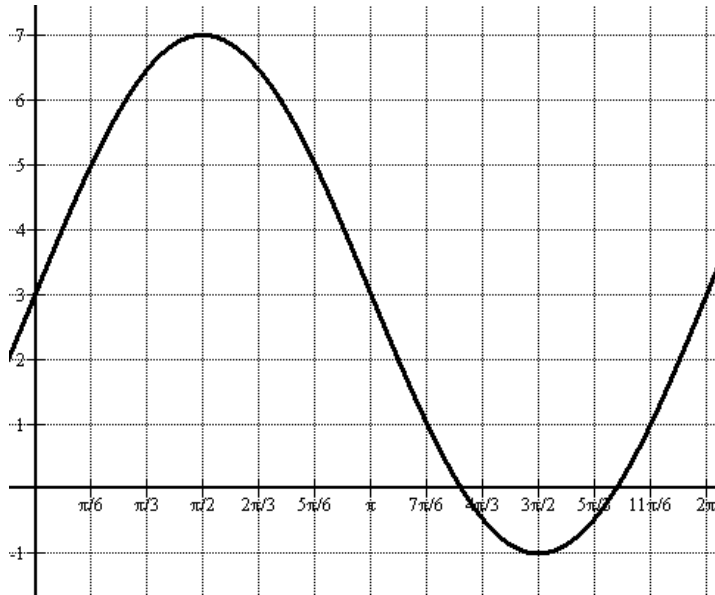
- a)  $x^2 + y^2 - 8x + 8y + 57 = 0$
- b)  $x^2 + y^2 - 8x + 8y + 7 = 0$
- c)  $x^2 + y^2 + 8x - 8y + 7 = 0$
- d)  $x^2 + y^2 + 8x - 8y + 57 = 0$



33. Given  $f(x) = \frac{4}{x-2}$  and  $g(x) = \frac{11}{2x^2 - 4x}$ , find and simplify  $f(x) - g(x)$ .

- a)  $\frac{8x - 11}{2x(x - 2)}$
- b)  $\frac{44}{(x - 2)(2x^2 - 4x)}$
- c)  $\frac{8x + 11}{2x(x - 2)}$
- d)  $\frac{9}{4x - 8x^2}$

34. What is the equation of the sine function in the graph shown?



- a)  $y = 4 \sin(x) + 3$
- b)  $y = 3 \sin(x) + 3$
- c)  $y = 4 \sin(x) + 1$
- d)  $y = 4 \sin(2x)$

35. Jaclyn wants to make vases and bowls for her pottery business. Each vase takes 1 pound of clay and each bowl takes  $\frac{1}{2}$  pound of clay. It takes her 30 minutes to make a vase or a bowl. She has 6 pounds of clay available and 4 hours of available time. What are the constraint equations for Jaclyn's situation? Let  $v$  = number of vases made and  $b$  = number of bowls made.

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>a) <math>v + b \leq 4</math></li> <li><math>v + \frac{1}{2} b \leq 6</math></li> <li><math>v \geq 0</math></li> <li><math>b \geq 0</math></li> </ul>                         | <ul style="list-style-type: none"> <li>b) <math>\frac{1}{2} v + \frac{1}{2} b \leq 4</math></li> <li><math>v + \frac{1}{2} b \leq 6</math></li> <li><math>v &gt; 0</math></li> <li><math>b &gt; 0</math></li> </ul> |
| <ul style="list-style-type: none"> <li>c) <math>\frac{1}{2} v + \frac{1}{2} b \leq 4</math></li> <li><math>v + \frac{1}{2} b \leq 6</math></li> <li><math>v \geq 0</math></li> <li><math>b \geq 0</math></li> </ul> | <ul style="list-style-type: none"> <li>d) <math>30v + 30b \leq 4</math></li> <li><math>v + 30b \leq 6</math></li> <li><math>v \geq 0</math></li> <li><math>b \geq 0</math></li> </ul>                               |

36. Which of the following is **NOT** a rational zero of  $f(x) = 2x^3 - x^2 - 23x - 20$ ?

- a) 1                      b) -1                      c) 4                      d)  $-5/2$

37. Find the x-coordinate of the solution to this system of equations:  
 $0.5x - 4y = -2$   
 $6y - 4 = x - 3$

- a)  $x = 1.5$   
b)  $x = 8$   
c)  $x = -2$   
d)  $x = 0.5$

38. Solve the equation  $\sqrt{7 - 3x} = 8$ .

- a)  $x = -10$                       b)  $x = -19$                       c)  $x = 19$                       d) no solution

39. Solve:  $9^{(x+2)} = 27^{(5-2x)}$ .

- a)  $x = 1.1$                       b)  $x = .727$                       c)  $x = 1.6$                       d)  $x = 1.375$

40. Describe the nature of the roots of  $x^3 - 5x^2 + 2x - 10$ .

- a) 3 positive real roots OR 1 positive real root and two imaginary roots  
b) 1 negative real root and 2 positive real roots OR 1 negative real root and 2 imaginary roots  
c) 3 imaginary roots  
d) 1 negative real root, 1 positive real root and one imaginary root

41. Determine the discriminant of  $f(x) = 3x^2 - 7x - 48$  and use it to find the type of roots of this polynomial.

- a) Two rational roots
- b) One real, double root
- c) Two irrational roots
- d) Two imaginary roots

42. Solve.  $\frac{x-2}{x+3} + \frac{4}{x} = \frac{10}{9x}$

- a)  $x = 6$
- b)  $x = 3\frac{1}{3}$
- c)  $x = 12$
- d) No solution.

43. Convert  $436^\circ$  to radians.

- a.  $\frac{45\pi}{109}$                       b.  $78480\pi$                       c.  $\frac{109\pi}{45}$                       d.  $\frac{\pi}{78480}$

44. Find the slant asymptote of the following rational function:  $\frac{3x^2+2x+1}{2x-3}$ .

- a.  $y = 2x - 3$
- b.  $y = \frac{3}{2}$
- c.  $y = 0$
- d.  $y = \frac{3}{2}x - \frac{13}{4}$

45. Suppose that  $p(x)$  is a polynomial with degree 5 and has a root of  $1 - 2i$ . Which of the following is true?

- a.  $p(x)$  has 4 real roots.
- b.  $p(x)$  has at least 3 real roots.
- c.  $p(x)$  has no real roots.
- d.  $p(x)$  has at least one real root.

46. What is the phase shift of  $2 + \sin(4(x + 40)) = y$

- a. left 40
- b. right 40
- c. left 10
- d. right 10

47. A projectile can be modeled by the equation  $y = -4.9x^2 + 16x + 8$ , where  $x$  is time in seconds and  $y$  is the height of the ball in meters. At what time(s) will the ball be 19.1 meters above the ground?

- a. 1 second
- b. 2.3 seconds
- c. both a and b
- d. the ball will never reach 19.1 meters

48. The Kelvin is named after Scott Calvin from the movie series “The Santa Clause”

- a. True      b. False

49. The Ferris Wheel was invented for the movie “Ferris Bueller’s Day Off” – which takes place in Chicago.

- a. True      b. False

50. John Napier is known in the math world as the Father of Statistics. He was a pretty average guy.

- a. True      b. False