

End-of-Course Assessment

Selected Response

Read each question. Then circle the letter(s) of the correct answer(s). There may be more than one correct response.

1. Find all solutions to the system of equations.

$$\begin{cases} -\frac{1}{2}x^2 + x - 1 = y \\ 2x - 1 = y \end{cases}$$

- A (-2, -5)
- B (2, 3)
- C (0, 1)
- D (0, -1)

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

$$-\frac{1}{2}x^2 - x = 0$$

$$x(-\frac{1}{2}x - 1) = 0$$

$$x = 0 \quad -\frac{1}{2}x - 1 = 0$$

$$x = 0 \quad -\frac{1}{2}x = 1$$

$$x = 0 \quad -x = 2$$

$$x = 0 \quad x = -2$$

2. Solve the equation.

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

- A $x = 1 - 2i$
- B $x = -1 + 2i$
- C $x = 1 + 2i$
- D $x = -1 - 2i$

$$(x-1)^2 = -4$$

$$x-1 = \pm 2i$$

$$x = 1 \pm 2i$$

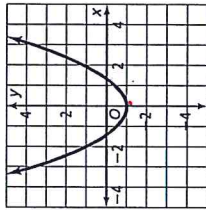
3. Which of the following are equivalent to $\sqrt[3]{42}$?

- A $\frac{1}{4}$
- B $\frac{2}{43}$
- C $\sqrt[3]{16}$
- D $\frac{2}{4}$

$$\sqrt[3]{42} = 4\frac{2}{3}$$

$$\sqrt[3]{16} = 2\sqrt[3]{2}$$

4. Which function does the graph represent?



- A $y = 2x^2 - 1$
- B $y = 2(x-1)^2$
- C $y = \frac{1}{2}x^2 - 1$
- D $y = \frac{1}{2}(x-1)^2$

$v: (0, -1)$
 $a = \text{over } 1, \text{ up } \frac{1}{2}$
 $y = \frac{1}{2}(x)^2 - 1$
 OR
 $v: (0, 1), \text{ pt: } (2, 1)$
 $1 = a(\Delta)^2 - 1$
 $1 = 4a - 1$
 $2 = 4a$
 $\frac{1}{2} = a$
 $y = \frac{1}{2}x^2 - 1$

5. What is $\frac{x^3 - 5x^2 + 2x + 8}{x - 2}$?

- A $x^2 - 3x - \frac{8}{x-2}$
- B $x^2 - 3x - \frac{12}{x-2}$
- C $x^2 - 3x$
- D $x^2 - 3x - 4$

$$\begin{array}{r} x^3 - 5x^2 + 2x + 8 \\ \underline{-(x^2 - 3x - 4)} \\ 4x^2 + 5x + 12 \\ \underline{-(4x^2 - 12x - 16)} \\ 17x + 28 \\ \underline{-(17x - 51 - 68)} \\ 85 \end{array}$$

6. Solve.

- A $x = -19$
- B $x = 3$
- C $x = 19$
- D $x = 57$

$$\sqrt{7-3x-8} = 0$$

$$-1 = -3x - 8$$

$$7 = -3x - 4$$

$$11 = -3x$$

$$x = -\frac{11}{3}$$

7. Solve the quadratic equation.

$$x^2 + 6x + 9 = 1$$

- A -4
- B -2
- C 2
- D 4

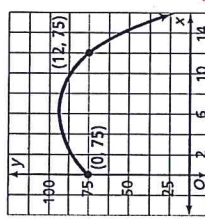
$$x^2 + 6x + 9 = 1$$

$$(x+3)^2 = 1$$

$$x+3 = \pm 1$$

$$x = -2, -4$$

8. You throw two tennis balls from the top of a building. The path of the first ball is modeled by the graph below, with the y-axis representing height and the x-axis representing the distance the ball travels in meters. The second ball travels higher than the first ball. Which of the following equations could model the path of the second ball?



- A $y = -0.5x^2 + 6x + 75$
- B $y = -0.5x^2 + 2x + 75$
- C $y = -0.2x^2 + 8x + 75$
- D $y = -0.2x^2 + 6x + 75$

Plug in 6
or change to vertex form. See below

9. Which of the following are equivalent to $x^{\frac{5}{3}}$?

- A $x\sqrt[3]{x^2}$
- B $\sqrt[3]{x^5}$
- C $\sqrt[3]{x}$
- D $\sqrt[3]{x}$

$$\sqrt[3]{x^5}$$

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10. What is $6 + \sqrt{-9}$ in the form $a + bi$?

- A $6 + 3i$
- B $6 - 3i$
- C $3 + 6i$
- D $3 - 6i$

$$6 + 3i$$

11. For which value(s) of x does $f(x) = g(x)$?

$$f(x) = |x - 5| + 2$$

$$g(x) = 8$$

- A $x = -5$
- B $x = -1$
- C $x = 1$
- D $x = 11$

$$|x-5| + 2 = 8$$

$$|x-5| = 6$$

$$x-5 = 6 \quad x-5 = -6$$

$$x = 11 \quad x = -1$$

12. What are the zeros of the function?

$$f(x) = 4x^2 - 3x - 7$$

- A $-\frac{7}{4}$
- B $-\frac{1}{4}$
- C 1
- D 4

$$0 = 4x^2 - 3x - 7$$

$$0 = (4x-7)(x+1)$$

$$4x-7 = 0 \quad x+1 = 0$$

$$4x = 7 \quad x = -1$$

$$x = \frac{7}{4} \quad x = -1$$

13. The first home on a street is numbered 17. The second home on the street is numbered 21. The third is 25, and the fourth is 29. Which formula gives the number for the n th home on the street?

- A $a_n = 17 + (n-1)4$
- B $a_n = 4 + (n-1)17$
- C $a_n = 4n + 13$
- D $a_n = 4n + 17$

$$17, 21, 25, 29$$

$$a_n = 17 + 4(n-1)$$

$$a_n = 17 + 4n - 4$$

$$a_n = 4n + 13$$

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14. Which of the following apply to the study method?
Advertisers ask every fifth parent in the stands at a football game about his or her preference of sports drinks.

- A survey
- B controlled experiment
- C observational study
- D convenience sample

15. What is the vertex of the graph of $y = -x^2 + 4x - 3$?

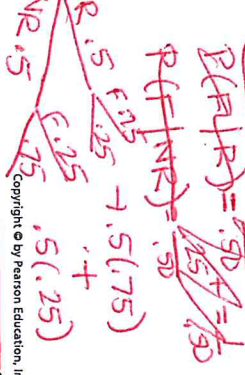
- A (-2, -15)
- B (-2, -7)
- C (2, 1)
- D (2, 9)

16. If $f(x) = 3x^2 - 2$ and $g(x) = -4x + 6$, what is $f + g$?

- A $-12x^3 + 18x^2 + 8x - 12$
- B $48x^2 - 144x + 106$
- C $3x^2 - 4x + 4$
- D $-12x^2 + 14$

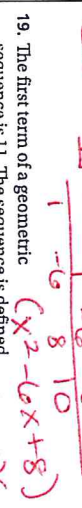
17. A squirrel has a 75% chance of finding food when it is sunny, but only a 25% chance of finding food when it is raining. Suppose there is a 50% chance of rain. What is the probability that a squirrel will find food?

- A 12.5%
- B 25%
- C 37.5%
- D 50%



18. Which of the following are zeros of the function?
 $f(x) = x^4 - 5x^3 + 20x - 16$

- A -2
- B 1
- C 2
- D 4

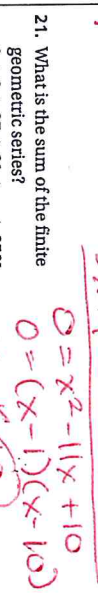


19. The first term of a geometric sequence is 11. The sequence is defined by the recursive formula $a_n = a_{n-1} \cdot 40$, for $n > 1$. Which is the explicit definition for this sequence?

- A $a_n = 40 \cdot 11^{n-1}$
- B $a_n = 11 \cdot 40^{n-1}$
- C $a_n = 11 \cdot n - 140$
- D $a_n = 40 \cdot n - 11$

20. Solve for x.

- A $x = 1$
- B $x = 5$
- C $x = 10$
- D There is no solution.



21. What is the sum of the finite geometric series?
 $3 + 9 + 27 + 81 + \dots + 6561$

- A 9840
- B 9846
- C 29,523
- D 89,572



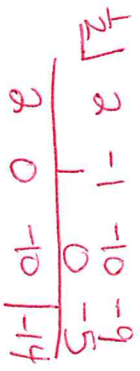
22. Simplify $125^{-\frac{2}{3}}$.

- A $\frac{1}{25}$
- B $\frac{1}{5}$
- C 5
- D 25



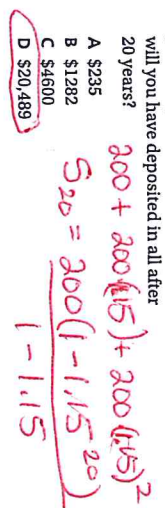
23. What is the remainder?
 $(2x^3 - x^2 - 10x - 9) \div (x - \frac{1}{2})$

- A 4
- B 0
- C -14
- D -18



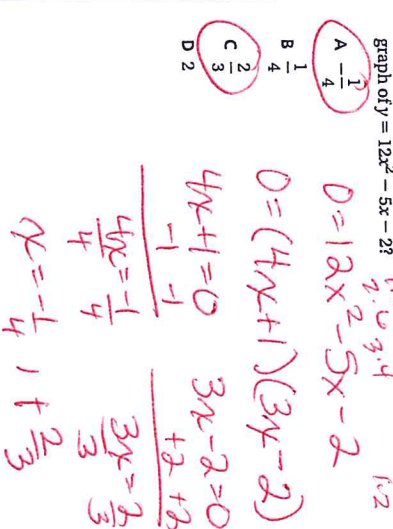
24. You deposit \$200 in a savings account. For each year thereafter, you plan to deposit 15% more than the previous year. About how much money will you have deposited in all after 20 years?

- A \$235
- B \$1282
- C \$4600
- D \$20,489



25. What are the x-intercept(s) of the graph of $y = 12x^2 - 5x - 2$?

- A $-\frac{1}{4}$
- B $\frac{1}{4}$
- C $\frac{2}{3}$
- D 2



Constructed Response

In this section, show all your work in the space beneath each test item.

26. Let $f(x) = 3x^2 + x - 2$ and $g(x) = 2x^2 + 1$. What is $2g(x) - f(x)$?

$$2(2x^2 + 1) - (3x^2 + x - 2)$$

$$4x^2 + 2 - 3x^2 - x + 2$$

$$x^2 - x + 4$$

27. Multiply and simplify $\sqrt{18} \cdot \sqrt[3]{-8}$.

$$\sqrt{18} = 3\sqrt{2}$$

$$\sqrt[3]{-8} = -2$$

$$3\sqrt{2} \cdot (-2) = -6\sqrt{2}$$

28. What is the equation of a parabola with directrix $x = 1$ and focus at $(-1, 0)$?

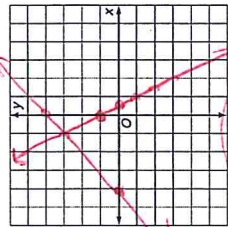
$$V: (0, 0)$$

$$a = \frac{1}{4}$$

$$x = -\frac{1}{4}y^2$$

29. Solve the system of equations by graphing.

$$\begin{cases} 2x + y = 1 \\ -x + y = 4 \end{cases}$$



$$(-1, 3)$$

30. What is the solution of the equation? Justify each step in your solution.

$$5.4x^2 - 0.03 = 16.17$$

$$+ 0.03 + 0.03$$

$$\frac{5.4x^2}{5.4} = \frac{16.2}{5.4}$$

$$x^2 = 3$$

$$x = \pm\sqrt{3}$$

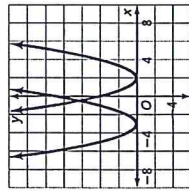
31. Solve $2^{4x} + 6 = 12$ for x . Round to the nearest thousandth.

$$2^{4x} = 6$$

$$\log_2 6 = 4x$$

$$x = \frac{\log_2 6}{4} \approx 0.646$$

32. The two quadratic functions graphed in the figure below are horizontal translations 5 units apart.



$$y = (x - 2)^2 + 0$$

$$y = (x - 3)^2 + 0$$

$$V: (2, 0)$$

$$(x - 2)^2 = (x + 3)^2$$

$$x - 2 = x + 3$$

The parabola on the right is defined by the equation $y = x^2 - 4x + 4$. At what point do the graphs intersect?

$$x^2 - 4x + 4 = x^2 + 6x + 9$$

$$-4x - 6x - 9 - 4x - 9$$

$$-10x - 5 = 0$$

$$-10x = 5$$

$$x = -\frac{1}{2}$$

$$y = (-\frac{1}{2})^2 = \frac{1}{4}$$

$$y = (-\frac{1}{2})^2 = \frac{1}{4}$$

$$y = \frac{25}{4}$$

$$(-\frac{1}{2}, \frac{25}{4})$$

34. The height of an archway is modeled by the equation $h = -2x^2 + 6.5$, where x is the horizontal distance from the middle of the arch, in meters. What is the approximate width of the archway?

$$0 = -2x^2 + 6.5$$

$$-6.5 = -2x^2$$

$$\frac{-6.5}{-2} = \frac{-2x^2}{-2}$$

$$3.25 = x^2$$

$$\sqrt{3.25} = x$$

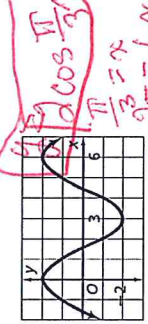
$$\frac{\sqrt{13} \cdot 2}{2} = \sqrt{13}$$

$$3.16 \text{ m}$$

35. The function $y = 245(1.06)^x$ shows the population growth of a city in thousands of people with a constant yearly growth rate. How fast does the population grow each year?

6.7% annually

36. Write an equation for the trigonometric function graphed below.



37. Write a function $f(x)$ that crosses the x -axis at $-2, -1, 1$, and 3 .

$$f(x) = (x + 2)(x + 1)(x - 1)(x - 3)$$

$$(x^2 - 1)(x^2 - x - 6)$$

$$x^4 - x^3 - 7x^2 + x + 6$$

38. A store has a sale where most items are 15% off. A customer has a coupon for \$25 off any sale item. The store will take 15% off the price after discounting any coupons. Write a function to represent the price of an item after both discounts.

$$f(x) = 0.85(x - 25)$$

$$= 0.85x - 21.25$$

39. If $f(x) = x^2 + 2x - 7$ and $g(x) = 3x - 4$, what is $f + g$?

$$(x^2 + 2x - 7) + (3x - 4)$$

$$x^2 + 5x - 11$$

40. Given that $\sin \theta = -0.2$ and $\tan \theta > 0$, what is $\cos \theta$?

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$(-0.2)^2 + \cos^2 \theta = 1$$

$$0.04 + \cos^2 \theta = 1$$

$$\cos^2 \theta = 0.96$$

$$\cos \theta = \pm\sqrt{0.96}$$

$$\cos \theta = -1.54$$

$$\cos \theta = -0.98$$

41. The manager of a factory wants to estimate how many of 500,000 dishwashers manufactured have defects. What would be an example of how the manager could use convenience sampling to find an estimate?

use the last 10 dishwashers manufactured this week. Answers vary

42. The function $f(x) = ax^2 + bx + c$ models the relation between the cost of a mobile phone x and the number of phones sold per month $f(x)$ in a particular city. What does the x -intercept of this graph mean? the price when no phones are sold

$$f(x) = 4x^4 - x^3 - 7x^2 + x + 6$$

$$= 4x^4 - x^3 - 7x^2 + x + 6$$

43. What is the asymptote of the graph of the function $f(x) = -6^x + 4$?

$$y = 4$$

44. Suppose a number from 1 to 100 is selected at random. What is the probability that a multiple of 9 or 10 is chosen?

$$P(9 \text{ or } 10) = P(9) + P(10) - P(9 \text{ and } 10)$$

$$\frac{11}{100} + \frac{10}{100} - \frac{2}{100} = \frac{19}{100}$$

45. What is the factored form of the expression $12x^2 - 26x - 10$?

$$2(6x^2 - 13x - 5)$$

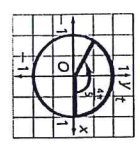
$$2(2x - 5)(3x + 1)$$

46. A bank manager wanted to determine the wait times for customers during lunch hours. She timed customers chosen at random.

Customer Wait Times (min)					
1.4	2.1	1.9	3.1	1.2	0.4
0.9	6.1	2.3	3.5	1.1	3.0
4.5	3.2	0.6	1.8	0.3	2.1

At a 95% confidence level, what is the margin of error rounded to the nearest tenth of a minute?

0.7 minutes



$\frac{4\pi}{5} = t$

48. Find all the zeros of the function $y = x^3 + 4x^2 - 8x - 32$.

$x = -4, \pm 2\sqrt{2}$
 $x^2(x+4) - 8(x+4)$
 $(x+4)(x^2-8) = 0$
 $x^2 = 8$
 $x = \pm 2\sqrt{2}$

49. Solve the system to the nearest hundredth.

$y = 3.46x$
 $y = 300$
 $3.46x = 300$
 $x = \frac{300}{3.46} \approx 86.71$

50. What are the solutions to the following equation?

$x(x-4) + 1(x-2) = 2$
 $x^2 - 4x + x - 2 = 2$
 $x^2 - 3x - 4 = 0$
 $(x-4)(x+1) = 0$
 $x = 4, -1$

Extended Response

In this section, show all your work in the space beneath each test item.

56. Consider $f(x) = x^2 + x + c$.

a. For what values of c are the roots of $f(x)$ real and distinct? Show or explain your work.

$b^2 - 4ac > 0$
 $1^2 - 4(1)c > 0$
 $1 - 4c > 0$
 $-4c > -1$
 $c < \frac{1}{4}$

b. Using one of the values for c that you found in part (a), determine the roots of $f(x)$. Show or explain your work.

$c = -2$
 $0 = x^2 + x - 2$
 $0 = (x+2)(x-1)$
 $x = -2, 1$
 Answers

57. A ball is thrown directly upward from a height of 50 ft with an initial velocity of 32 ft/s. The equation $h = -16t^2 + 32t + 50$ gives the height h after t seconds.

a. How long does it take for the ball to reach its maximum height? Show or explain your work.

$v = -\frac{b}{2a} = \frac{-32}{2(-16)} = 1$
 $t = 1$ second
 $h = -16(1)^2 + 32(1) + 50 = 66$
 66 ft

b. What is the maximum height of the ball? Show or explain your work.

66 feet

51. Rewrite $-\sqrt{24x^3y^4}$ in simplest form.

$-2\sqrt{3}xy^2\sqrt{6x}$

52. What value(s) of x are NOT possible for the function $f(x) = \frac{x-3}{x^2+3x-18}$?

$x \neq -6, 3$

53. Find the sum of the geometric series $5, -10, 20, \dots, -640$.

$S_n = 5(1 - (-2)^8) / (-2 - 1)$
 $S_8 = 5(1 - 256) / -3$
 $S_8 = 5(-255) / -3 = 425$

54. You roll two standard number cubes. Find the probability that the sum will be even or a multiple of 3.

Hand-drawn probability tree for two dice rolls. Outcomes are listed as (1,1) through (6,6). The sum of each outcome is written next to it. The sums 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 are circled. The probability for each sum is calculated: $P(2) = \frac{1}{36}$, $P(3) = \frac{2}{36}$, $P(4) = \frac{3}{36}$, $P(5) = \frac{4}{36}$, $P(6) = \frac{5}{36}$, $P(7) = \frac{6}{36}$, $P(8) = \frac{5}{36}$, $P(9) = \frac{4}{36}$, $P(10) = \frac{3}{36}$, $P(11) = \frac{2}{36}$, $P(12) = \frac{1}{36}$. The total probability for sums that are even or multiples of 3 is $\frac{24}{36} = \frac{2}{3}$.

55. A furniture store claims that it sells couches for an average of \$825. The prices of the couches are shown in the table below. Of mean, median, and mode, which measure is the store using in its claim?

Prices of Couches			
\$900	\$1250	\$850	\$1650
\$700	\$800	\$750	\$750

700 750 750 800 850 900 1250 1650
 # 825
 add + divide by 8 median
 mean: \$956.25 mode: \$750

58. n and $n + 1$ are consecutive integers.

a. Expand the expression $(7 + 8)^2$.

$$49 + 2 \cdot 56 + 64$$

$$49 + 112 + 64$$

$$161 + 64$$

$$225$$

b. Prove that the square of the sum of two consecutive positive integers is always odd.

The sum of consecutive positive integers is always odd and an odd-odd is odd, so the square of two consecutive integers is always odd. OR
 (even+odd)² (odd+even)²
 even² + 2evenodd + odd² same by commutative property
 even + even + odd = odd

59. Use the parent function $y = x^3$.

a. How does the graph of $y = 2x^3 + 3$ compare to the graph of the parent function?

vertical stretch by a factor 2, vertical translation up 3

b. What is the equation of the graph of the parent function under a vertical stretch or compression by the factor $\frac{1}{3}$, a reflection in the x -axis, and a horizontal translation that is 5 units to the left?

$$y = -\frac{1}{3}(x+5)^3$$

60. Consider the function $f(x) = -3 \ln(x-4)$.

a. What are the domain and range of $f(x)$? What is the vertical asymptote of the graph of $f(x)$?

*D: $x-4 > 0$ vertical asymptote: $x=4$
 $x > 4$*

R: ARN

b. Where do the graphs of $f(x)$ and $g(x) = x + 3$ intersect?

Need graphing calc.
 $x+3 = -3 \ln(x-4)$
 $x+3 = \ln(x-4)^{-3}$
 $e^{x+3} = (x-4)^{-3}$

61. Use the system of equations to answer the following questions.

$$\begin{cases} y = x^2 - 4x - 30 \\ 2y + 8x = -10 \end{cases}$$

a. Solve the equation $2y + 8x = -10$ by substituting the expression for y in the first equation into the second equation.

$$2(x^2 - 4x - 30) + 8x = -10$$

$$2x^2 - 8x - 60 + 8x = -10$$

$$2x^2 - 60 = -10$$

$$2x^2 = 50$$

$$x^2 = 25$$

$$x = \pm 5$$

$$y = x^2 - 4x - 30$$

$$y = 5^2 - 4(5) - 30 = 25 - 20 - 30 = -25$$

$$y = (-5)^2 - 4(-5) - 30 = 25 + 20 - 30 = 15$$

(5, -25) (-5, 15)

b. At what points do the graphs of the equations intersect?

*(5, -25)
 (-5, 15)*

62. Consider the function $f(x) = 4x^3 + 2x^2 - 2x + 3$.

a. What is the quotient when dividing $f(x)$ by $(x + 1)$?

$$\begin{array}{r} -1 \downarrow 4x^3 + 2x^2 - 2x + 3 \\ \underline{4x^3 + 4x^2} \\ -2x^2 - 2x + 3 \\ \underline{-2x^2 - 2x} \\ 3 \end{array}$$

b. What is the remainder?

R 3

63. A sales clerk makes \$20 in commission for selling her first digital recorder and an additional \$4 in commission for each digital recorder she sells after that.

a. Write an explicit formula for the commission she would make selling n digital recorders.

$$20, 24, 28$$

$$a_n = 20 + (n-1)4$$

$$a_n = 20 + 4n - 4$$

$$a_n = 4n + 16$$

b. Is it possible for her to make \$162 in commission selling digital recorders? Why or why not?

$$162 = 20 + (n-1)4$$

$$\underline{-20 \quad -20}$$

$$142 = 4n - 4$$

$$\underline{+4 \quad +4}$$

$$146 = 4n$$

$$\underline{ \quad } \div 4}$$

$$36.5 = n$$

no, she would have to sell 36.5 recorders, which isn't possible.

64. The table shows the grade point averages (GPAs) of 25 students in a school.

Students' GPAs				
3.05	2.98	3.12	2.5	2.09
3.74	3.25	2.98	3.01	2.29
4.0	2.87	3.75	3.0	2.8
3.11	3.0	2.75	2.85	3.34
3.49	2.5	2.90	3.16	4.0

a. What are the mean and standard deviation of the sample? Round to the nearest hundredth.

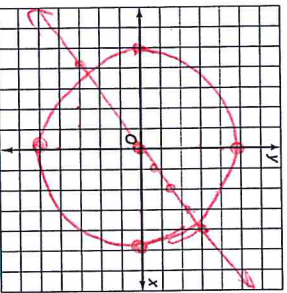
3.06 0.47

b. At a 95% confidence level, what is the approximate margin of error? Round to the nearest hundredth.

1.94, $\frac{0.47}{\sqrt{25}} = 0.094$

$$\begin{cases} 4y = 3x \\ x^2 + y^2 = 25 \end{cases}$$

a. Solve the system graphically.



(4, 3), (-4, -3)

b. Check your answer by solving the system algebraically.

$$x^2 + \left(\frac{3}{4}x\right)^2 = 25$$

$$x^2 + \frac{9}{16}x^2 = 25$$

$$\frac{16}{16}x^2 + \frac{9}{16}x^2 = 25$$

$$\frac{25}{16}x^2 = 25$$

$$x^2 = 16$$

$$x = \pm 4$$

$y = \frac{3}{4} \cdot 4 = 3$ (4, 3)
 $y = \frac{3}{4} \cdot -4 = -3$ (-4, -3)