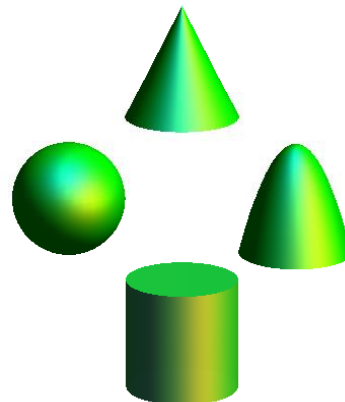




2019
High School Math Contest

Level 2
Exam



Lenoir-Rhyne University

*Donald and Helen Schort School of
Mathematics and Computing Sciences*

This exam was prepared by Stephanie Hays and Timothy Goldberg of LRU.

Do's and Don'ts:

- **Do NOT** open this booklet until you are instructed to do so.
- **NO Calculators** (or other electronic devices)
- Contestants with electronic devices (on or off) will be **disqualified!**
And their **team** will be **disqualified!**
(The other team members will continue to participate in the individual contest.)

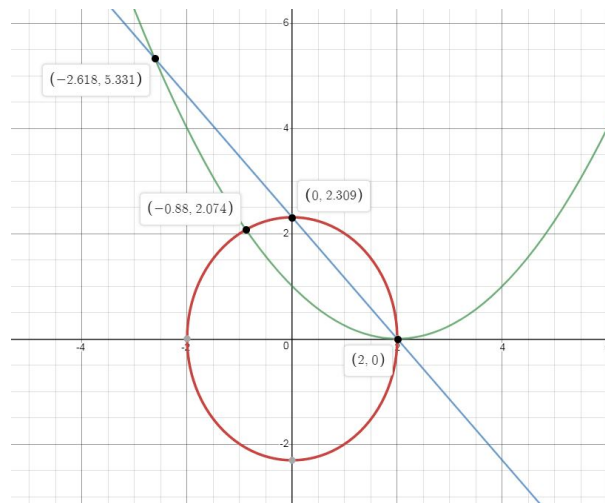
DIRECTIONS:

- **The Score Card:**
Write:
 - Your **NAME** on the “name line” (of course).
 - “**Level 2**” on the “subject line”.
 - Your **SCHOOL** on the “**Date Line**”
- **Clearly mark** ONE bubble using **#2 PENCIL**.
 - Light marks will be counted as unmarked!
 - **Completely erase** any changes.
- You **can** write on this test booklet (but the test booklet will not be graded).
- **Tie Breakers:** In case of ties, the person with the least number of *wrong answers* wins.
(A *blank* is better than *incorrect!*)
- **The Exam:** 30 problems, 70 minutes.
- Problems are NOT in order of increasing difficulty, so feel free to skip around. (Just be careful to mark your answers correctly on your score card!)

- **WAIT** for the signal to begin.

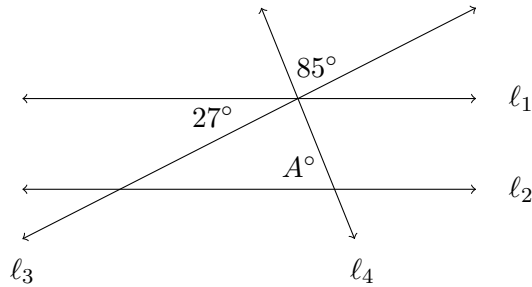
- The expression $c^{a/t}$ can be written as:
 (A) $\sqrt[t]{a^t}$ (B) $\sqrt[t]{t^a}$ (C) $\sqrt[a]{c^t}$ (D) $\sqrt[t]{c^a}$ (E) None of the answers (A)–(D) is correct.
- How much wood could a woodchuck chuck if a woodchuck could chuck $t^{150,000}$ pieces of wood?
 (A) 150,000 pieces (B) 75,000 pieces (C) 1 piece (D) 0 pieces
 (E) None of the answers (A)–(D) is correct.
- The area of a covered patio is 192 square feet. The length is four feet longer than the width. What is the length of the covered patio?
 (A) 10 feet (B) 12 feet (C) 14 feet (D) 16 feet
 (E) None of the answers (A)–(D) is correct.
- Simplify:

$$(2x^2 - 17x + 5) - (2x^2 - 3x + 2) + (x^2 + 7x)$$
 (A) $x^2 - 7x + 7$ (B) $5x^2 - 13x + 7$ (C) $x^2 - 7x + 3$ (D) $x^2 - 13x + 7$
 (E) None of the answers (A)–(D) is correct.
- The graphs of three equations are shown below. What is the solution to this system of these equations?



- (A) $(-2.618, 5.331)$ (B) $(-0.88, 2.074)$ (C) $(0, 2.309)$ (D) $(2, 0)$
 (E) There is no solution.

6. In the diagram below, lines l_1 and l_2 are cut by transversals l_3 and l_4 .



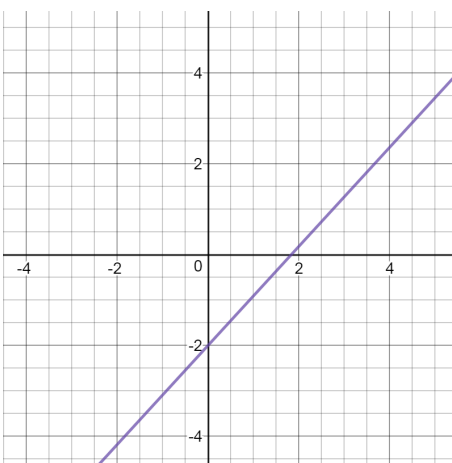
What value of A would make lines l_1 and l_2 parallel?

- (A) 95 (B) 85 (C) 63 (D) 60 (E) None of the answers (A)–(D) is correct.
7. There are 5 students with blonde hair, 8 students with brown hair, 7 students with black hair, 2 students with red hair, and 3 students who are bald. What is the approximate probability that a randomly chosen student has black hair or red hair?
- (A) 8% (B) 28% (C) 36% (D) 64% (E) None of the answers (A)–(D) is correct.
8. A ladder is 10 feet long. It leans against a wall, and reaches 9 feet up the wall. What is the distance in feet from the base of the wall to the base of the ladder?
- (A) $\sqrt{19}$ (B) 19 (C) $\sqrt{181}$ (D) 181 (E) None of the answers (A)–(D) is correct.
9. The same 10-foot ladder is leaning against the same wall as described in the previous problem, but this time it reaches 7 feet up the wall. Let θ be the measure of the angle formed when the ladder meets the wall. What is $\sin \theta$?
- (A) $\frac{9}{10}$ (B) $\frac{\sqrt{51}}{10}$ (C) $\frac{10}{9}$ (D) $\frac{\sqrt{51}}{9}$ (E) None of the answers (A)–(D) is correct.

10. What is the solution to the equation $\sqrt{3x} + 10 = 1$?
- (A) -36 (B) -9 (C) 27 (D) There is no real solution.
(E) None of the answers (A)–(D) is correct.

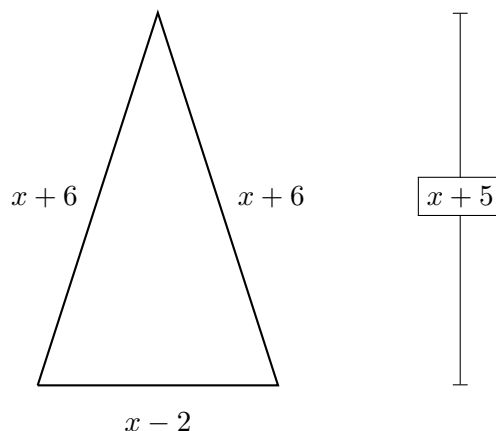
11. Divide 40 by $\frac{1}{2}$ and add 7. What is the result?
- (A) 20 (B) 27 (C) 80 (D) 87 (E) None of the answers (A)–(D) is correct.

12. If you take the line graphed below and change the x -intercept to -2 , but leave the slope unchanged, how would the new line compare to the original line below?



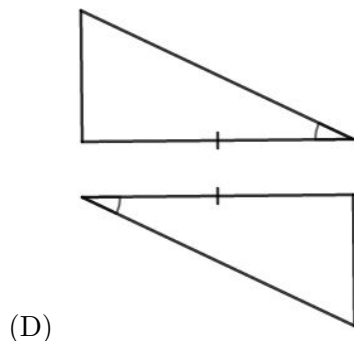
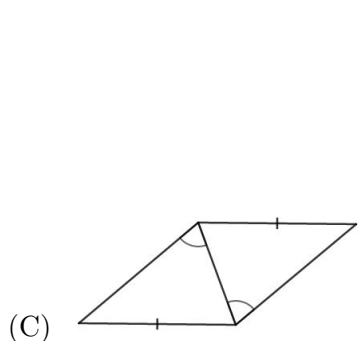
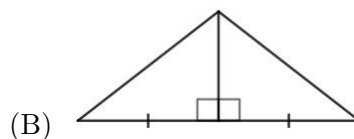
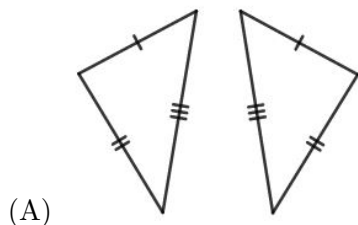
- (A) The new line will intersect the original line.
(B) The new line will be parallel to the original line.
(C) The new line will be perpendicular to the original line.
(D) The new line will be the same as the original line.
(E) None of the answers (A)–(D) is correct.
13. You just rolled a fair six-sided die and it shows a 4. What is the probability that your next roll of the same die shows a 3?
- (A) $\frac{1}{5}$ (B) $\frac{1}{6}$ (C) $\frac{1}{2}$ (D) 1 (E) None of the answers (A)–(D) is correct.

14. Find the area of the following triangle.



- (A) $\frac{1}{2}(x^2 + 3x + 10)$ (B) $\frac{1}{2}(x^2 + 4x - 12)$ (C) $\frac{x^2}{2} + \frac{3x}{2} - 5$ (D) $\frac{x^2}{2} + 2x + 6$
(E) None of the answers (A)–(D) is correct.
15. How can the graph of $f(x) = (x - 3)^2 - 4$ be obtained from the graph of $y = x^2$?
- (A) Shift the graph 3 units left and 4 units down.
(B) Shift the graph 4 units right and 3 units down.
(C) Shift the graph 3 units left and 4 units up.
(D) Shift the graph 3 units right and 4 units down.
(E) None of the answers (A)–(D) is correct.
16. At the end of the 2018–2019 football season, 53 Super Bowl games had been played with the current two football leagues, the American Football Conference (AFC) and the National Football Conference (NFC). At that time, the NFC had won one more game than the AFC. Determine the total number of wins by the AFC.
- (A) 25 (B) 26 (C) 27 (D) 28 (E) None of the answers (A)–(D) is correct.
17. Find the solutions to the equation $x^2 + x + 5 = 0$.
- (A) -3 and -2 (B) -5 and -1 (C) $-\frac{1}{2} \pm \left(\frac{\sqrt{19}}{2}\right)i$ (D) $-\frac{1}{2} \pm (\sqrt{19})i$
(E) There is not enough information to answer this question.

18. Which pair of triangles can be proved congruent using the SAS (side-angle-side) method?



(E) None of the answers (A)–(D) is correct.

19. The table below represents the total cost of renting a car. The total cost has a constant rate of change with respect to the time renting the car. What is the rate of change (in dollars per day), and what does the rate of change mean for the situation?

Time Renting Car (days)	Total Cost (dollars)
1	35
3	63
4	77
7	119

(A) 7; You rent a car for 7 days. (B) 119; Your charge for renting the car is \$119.

(C) 14/1; You are charged \$14 for every day you rent the car.

(D) 1/14; For every day you rent the car, you are charged \$14.

(E) None of the answers (A)–(D) is correct.

20. Which statement is logically equivalent to “If it is raining, then I am carrying an umbrella.”?

- (A) “If it is not raining, then I am not carrying an umbrella.”
- (B) “If I am not carrying an umbrella, then it is not raining.”
- (C) “If I am carrying an umbrella, then it is raining.”
- (D) “It is raining if and only if I am carrying an umbrella.”
- (E) None of the answers (A)–(D) is correct.

21. In a certain function y varies inversely with x . If $y = -\frac{5}{4}$ when $x = -4$, find y when $x = 3$.

- (A) $y = \frac{5}{3}$ (B) $y = -\frac{15}{16}$ (C) $y = -\frac{5}{3}$ (D) $y = \frac{15}{16}$
- (E) None of the answers (A)–(D) is correct.

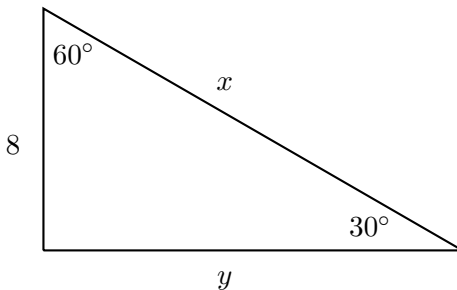
22. A box contains five pennies, three nickels, seven dimes, and two quarters. If a coin is selected from this box at random, what is the approximate probability that it is a dime, given that the coin has a silver appearance?

- (A) 17% (B) 25% (C) 41% (D) 58% (E) None of the answers (A)–(D) is correct.

23. A farmer had nineteen sheep, and all but eight died. How many does she have left?

- (A) 8 (B) 11 (C) 19 (D) 27 (E) None of the answers (A)–(D) is correct.

24. Find the value of y in the following diagram.



- (A) 8 (B) $8\sqrt{2}$ (C) $8\sqrt{3}$ (D) 16 (E) None of the answers (A)–(D) is correct.

25. Expand $(3x^2 + 4x)(x - 5)$.
- (A) $3x^3 - 11x^2 - 20x$ (B) $3x^3 - 15x^2 + 4x - 20$ (C) $3x^3 - 19x^2 + 20x$ (D) $3x^3 + 15x^2 + 4x + 20$
(E) None of the answers (A)–(D) is correct.
26. Martha's mother had four children, and she often named them after the days of the week. Her first child was named Monday, her second child was named Tuesday, and her third child was named Wednesday. What was her last child's name?
- (A) Thursday (B) Friday (C) Saturday (D) Sunday
(E) None of the answers (A)–(D) is correct.
27. The numbers $x = 1$, $x = -1$, and $x = 3i$ are roots of a certain polynomial function. Assuming all coefficients are real, what is the minimum possible degree of the polynomial function?
- (A) 6 (B) 5 (C) 4 (D) 3 (E) None of the answers (A)–(D) is correct.
28. Two years ago, Cua invested \$2400 in a savings account earning 2% interest compounded annually. To the nearest dollar, how much money is in her account now?
- (A) \$2,424 (B) \$2,497 (C) \$2,518 (D) \$4,800
(E) None of the answers (A)–(D) is correct.
29. Which of the following are true?
- (i) When you double the side length of a square, the perimeter doubles.
(ii) When you double the side length of a square, the area quadruples.
(iii) When you double the side length of a cube, the volume increases by a factor of 8.
- (A) Only (i) and (ii) are true. (B) Only (i) and (iii) are true.
(C) Only (ii) and (iii) are true. (D) All are true. (E) None are true.

