Math Day 2020
at Murray State University
Lower Level Examination

Do not open this exam until you are told to do so.

Clearly fill in your NAME and STUDENT NUMBER on the bubble sheet. Your student number is located on the card your teacher gave you.

You have 60 minutes to complete this exam.

You may not use a calculator, phone, notes, book, or other aid. Any attempt to do so will result in disqualification.

The exam will be scored as follows:

+1 point for a correct answer

$\frac{1}{4}$ point for an incorrect answer

0 points for a blank answer

Clearly select one answselet.sel selherudenesn.nswp

1. The circles shown are tangent at point

4. A certain jar contains 60 jelly beans: 22 white, 18 green, 11 yellow, 5 red, and 4 purple. If a jelly bean is to be chosen at random, what is the probability that the jelly bean will be neither red nor purple?

   (a) 0.09

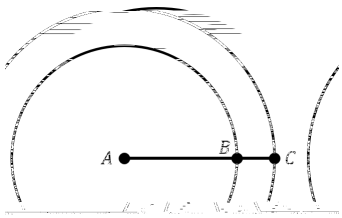
   (b) 0.85

   (c) 0.15

   (d) 0.54

   (e) 0.91

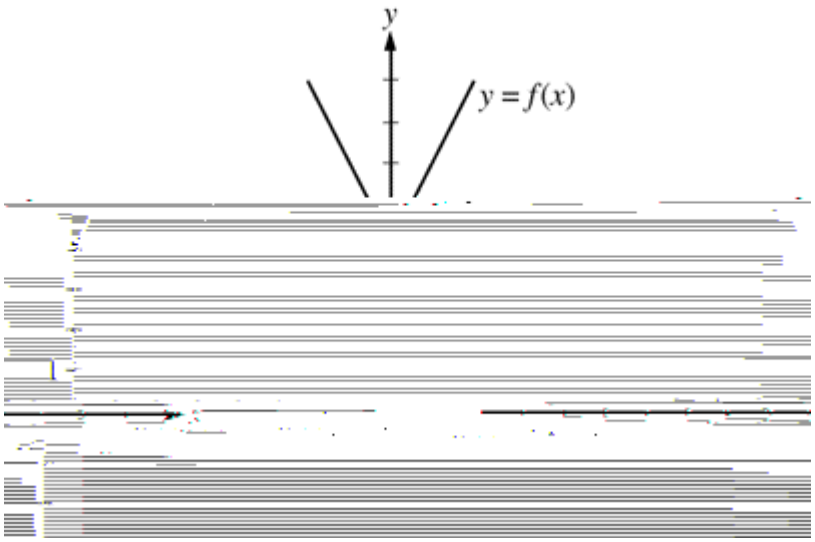
5. The gure below illustrates two circles where $AB = 3BC$. Choose the correct conclusion.



   (a) The area between the inner circle and outer circle is less than the area of the inner circle.

   (b) The area between the inner circle and outer circle is greater than the area of the

6. The gure below shows the graph of a function f, de ned by $f(x) = j2xj + 4$ for all numbers x. For which of the following functions g de ned for all numbers x does the graph of g intersect the graph of f?



(a) $g(x) = x + 3$

(b) $g(x) = 2x \quad 2$

(c) $g(x) = 3x \quad 2$

(d) $g(x) = x \quad 2$

(e) $g(x) = 2x + 3$

7. Which of the following could be the ones digit of 43^n, where n is a positive integer?

(a) 8

(b) 0

(c) 1

(d) 5

(e) 6

8. Solve the given system of linear equations by graphing.

$$y \quad x + 4$$

$$2x + y \quad 4$$

(a)

9. Working alone at its constant rate, a new machine produces $3k$ car parts in 8 minutes. Working alone at its constant rate, an older machine produces k car parts in 24 minutes. Working together simultaneously, how many minutes does it take both machines to produce $5k$ car parts?

   (a) 6 minutes

   (b) 16 minutes

   (c) 3 minutes

   (d) 8 minutes

   (e) 12 minutes

10. Suppose general ticket prices to a basketball game are p dollars and student ticket prices are \$10. If we wish to make exactly \$5000 from total ticket sales and there are 200 total seats available, which of the following prices p would not be an allowable charge?

   (a) \$20

   (b) \$30

   (c) \$40

   (d) \$50

   (e) None of the above

11. In the gure below, the line segments

12. A recursive function $f(x)$ is de ned as $f(x) = xf(x \quad 1)$. If $f(1) = 1$, determine $f(5)$.

(a) 1

(b) 5

(c) 20

(d) 25

(e) 120

13. Two cards are drawn from a standard deck of 52 playing cards without replacement, what is the probability of getting two cards of the same rank (in other words, a pair)?

(a) 1/8

(b) 1/4

(c) 3/51

(d) 4/13

(e) None of the above

14. How many real solutions does the following equation have?

$$22 \quad 8(x \quad 1)^2 + 2x = (2x + 6)(5 \quad 4x)$$

(a) 0

(b) 1

(c) 2

(d) An in nite number

(e) No solutions

15. A government regulation for food pantry box distributions requires that all boxes must contain the same proportions of pasta, canned vegetables, and canned meats, in other words, one box cannot have more pasta than another box, similarly for the canned vegetables and meats. Given that a food pantry has 360 pasta items, 540 canned vegetables, and 240 canned meats in stock, how many food boxes can be created that meet the government regulation and distributes all the food.

    (a) 19

    (b) 30

    (c) 60

    (d) 90

    (e) 240

16. An army laying siege to a walled city sends out two scouts in the dead of night to determine the height of the wall. A ve foot scout carefully walks towards the wall making a mark in the sand where the top of his head is in direct line of site with the top of the wall and the other scout's eye-level from two feet above the ground. See the gure the

17. If $4^x = 1024$, then $(4^{x+1})(5^{x-1}) =$

(a) 10^6

(b) $(5^4)(10^5)$

(c) $(4^4)(10^5)$

(d) $(5^4)(10^4)$

(e) $(4^4)(10^4)$

18. Compute the sum of the interior angles for the polygon illustrated below.

(a) 360°

(b) 540°

(c) 720°

(d) 1080°

(e) Cannot be determined from the information given

19. If $6x^2 + x = 2$ and $x > 0$, then x must equal which of the following?

(a) 1/2

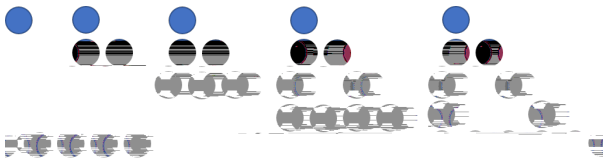
(b) 1

(c) 3/2

(d) 2

(e) -2/3

20. Using the pattern of the ve triangles in the gure below, how many dots would appear in the 30^{th} triangle?



(a) 54

(b) 60

(c) 87

(d) 90

(e) 120

21. In how many distinct ways can a 6 character pass-code be formed consisting of exactly three A's and three B's?

(a) 18

(b) 20

(c) 36

(d) 64

(e) 120

22. Determine which of the following statements is always true.

(a) If $ABCD$ is a rhombus, then it is a parallelogram.

(b) If $\backslash A$ is acute, then $4ABC$ is acute.

(c) If $ABCD$ is a parallelogram, then it is a rectangle.

(d) If $4ABC$ is isosceles, then $\overline{AB} = \overline{BC}$.

(e) None of the above.

23. A highly-secured pass-code to enter a top-secret facility consists of the digits 0-9 only, no digit may be repeated, and the code is at least 9 digits long. How many pass-codes are possible?

    (a) 90

    (b) 9!

    (c) 9! + 10!

    (d) 2 10!

    (e) 9! 10!

24. If $0 < st < 1$, then which of the following can be true?

    (a) $s < 1$ and $t > 0$

    (b) $s < 1$ and $t < 1$

    (c) $s > 1$ and $t < 1$

    (d) $s > 1$ and $t < 1$

    (e) $s > 1$ and $t > 1$

25. At a local convenience store, candy bars that normally sell for 59 cents each are on sale at 2 for 99 cents. How much can be saved by purchasing 10 of these candy bars at the sale price?

    (a) $0.85

    (b) $0.95

    (c) $1.00

    (d) $1.05

    (e) $1.10

26. Two machines S and T produce 1000 and 2000 auto parts every day, respectively. On average, Machine S produces 10 defective parts and machine T produces 40 defective parts each day. A quality control engineer nds that a part is defective. What is the probability that it came from machine S.

    (a) 1/4

    (b) 1/5

    (c) 1/7

    (d) 1/60

    (e) 1/300

27. If a and b are the roots of the equation $x^2 - 6x + 8 = 0$, then the absolute value of $(a + b)(a - b)$ is

    (a) -12
    (b) 4
    (c) 8
    (d) 12
    (e) 16

28. Find the equation of the line perpendicular to $4x - 5y = 10$ that passes through the point $(-2; 6)$.

    (a) $4x - 5y = -38$
    (b) $5x - 4y = -34$
    (c) $5x - 4y = -14$
    (d) $5x + 4y = 14$
    (e) $5x + 4y = 34$

29. In the figure, O is the center of the circle and P, Q, and R are on the circle where O is contained inside of $\triangle PQR$. Given that $\angle QPO + \angle OPR = 50^\circ$, the $\angle QOR$ is

    (a) 50°
    (b) 90°
    (c) 100°
    (d) 130°
    (e) Cannot be determined from the information given

30. What is the greatest distance between two vertices of a rectangular solid with a height of 5, a length of 12, and a volume of 780?

(a) 12
(b) $12\sqrt{2}$
(c) 13
(d) $13\sqrt{2}$
(e) $13\sqrt{3}$