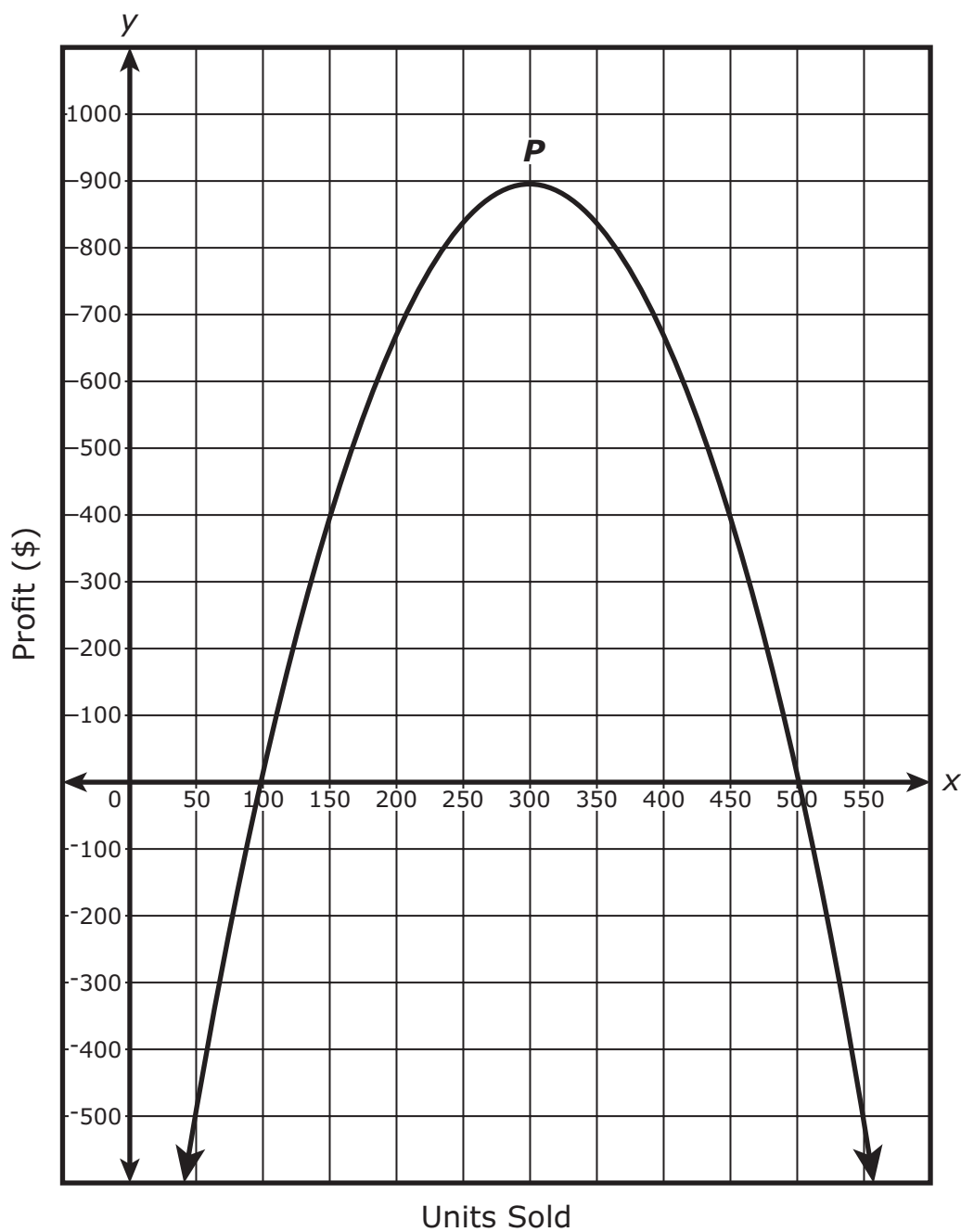


ALGEBRA II
MATHEMATICS

1. This question has two parts.

A company's profit in dollars, $P(x)$, from selling x units of a product can be modeled by the function shown in the graph.



Part A

Analyze the graph and select the statement that correctly interprets a key feature of the graph in terms of the company's profits.

- A.** The maximum profit is \$300.
- B.** The company must sell at least 100 units in order to make a profit.
- C.** When more units are sold, the company makes more profit.
- D.** There is symmetry in the graph of the profit function about the line $x = 900$.

Part B

The company introduces a marketing strategy that is expected to change the profit function to $Q(x) = -\frac{1}{50}(150 - x)(650 - x)$.

How much greater is the maximum profit for the model $Q(x)$ than for the model $P(x)$?

- A.** \$50
- B.** \$100
- C.** \$150
- D.** \$350

2. This question has two parts.

In 2021, the national average SAT test scores are normally distributed with a mean score of 1060 and a standard deviation of 217 points. At a certain testing site, 400 students are taking the SAT test.

Part A

How many of the 400 students at this testing site would be expected to have an SAT score of at least 843 but no more than 1277?

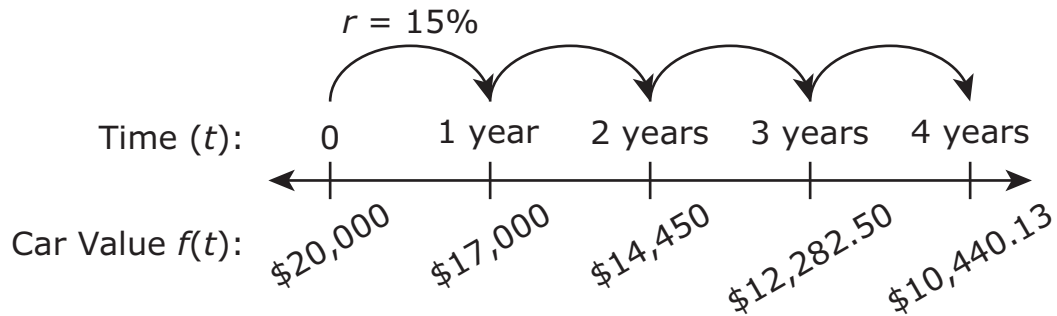
Enter your answer in the box. Your answer must be a whole number.

Part B

How many of the 400 students at this testing site would be expected to have an SAT score greater than 1494?

Enter your answer in the box. Your answer must be a whole number.

3. John bought a car for \$20,000. The number line shows how the value of John's car in dollars decreased at a rate of 15% each year for 4 years.



Which function **best** represents the depreciation of John's car?

- A. $f(t) = 20,000t$
- B. $f(t) = (20,000)\left(\frac{1}{t}\right)$
- C. $f(t) = 20,000(0.85)^t$
- D. $f(t) = 20,000 - 0.15t$

- 4.** Rose is shopping at a booth where attire is sold. There are 80 hats at one table and 120 shirts at a second table. There are 20 small shirts, 50 medium shirts, and 50 large shirts.

Hats cost \$18.75 each. Small shirts cost \$10.50. Medium shirts cost \$12.50 each. The large shirts are not marked with a price. Rose has \$150 to spend.

- Suppose that Rose buys 6 hats. Write an equation to determine the number of medium shirts she can buy. How many medium shirts can she buy?
- Suppose that Rose buys 6 small shirts. Write an equation to determine the number of hats she can buy. How many hats can she buy?
- If the vendor sells all the hats and all the shirts, about how much revenue will be made? Explain any assumptions that factored into your answer.

Enter your answers and explanations in the box.

- 5.** What are the next two terms in the sequence 15, 45, 135, ... ?

- A.** 180 and 315
- B.** 225 and 315
- C.** 405 and 1,215
- D.** 540 and 2,160

6. What is the explicit formula for the arithmetic sequence $-8, -1, 6, 13, \dots$?

A. $a_n = 7n - 15$

B. $a_n = -8 + 7n$

C. $a_n = 15 - 7n$

D. $a_n = 7 + 7n$

7. Which quadratic equation does not have real solutions?

A. $x^2 - x - 10 = 5$

B. $x^2 = -16$

C. $4x^2 + 4x + 1 = 0$

D. $9x^2 - 25 = 0$

8. What is the remainder when $P(x)$ is divided by $(x - 2)$?

$$P(x) = x^4 - 3x^3 - 2x^2 + 5$$

Enter your answer in the space.

9. Consider the equation $e^{2x} = x + 3$.

- How many negative solutions are there to the equation?
- Explain how you know.

Enter your answer in the space provided. Show all your work to support your answer.

10. Which ordered pairs are the solutions to the system of equations?

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

Select all the correct answers.

A. $(-2, -4)$

B. $(-2, 4)$

C. $(0, -4)$

D. $(0, 0)$

E. $(2, -4)$

F. $(2, 4)$

- 11.** A scientist is studying a metal's cooling rate. The metal's temperature, $T(t)$, can be modeled using the equation shown.

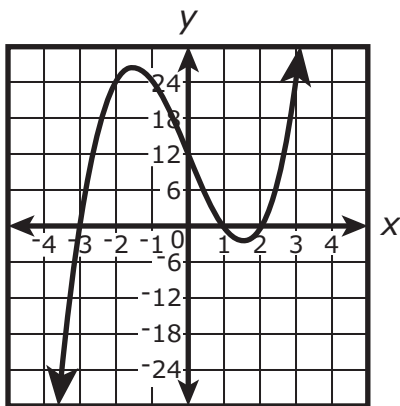
$$T(t) = 20 + 60e^{-0.05t}$$

In the equation, T is measured in degrees Celsius ($^{\circ}\text{C}$) and the time, t , is measured in minutes after the initial heating. To find the time it took for the metal to cool to 50°C , which equation could the scientist use?

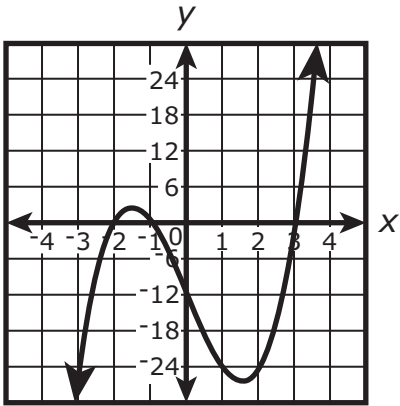
- A.** $t = -\frac{\ln(0.5)}{0.05}$ **B.** $t = \ln\left(-\frac{0.5}{0.05}\right)$
C. $t = -\frac{\ln(2)}{0.05}$ **D.** $t = \ln\left(\frac{2}{0.05}\right)$

- 12.** Consider the polynomial function $f(x) = 2(x - 1)(x + 3)(x - 2)$. Which graph best represents this function?

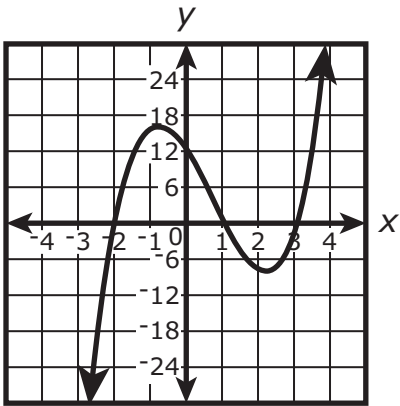
A.



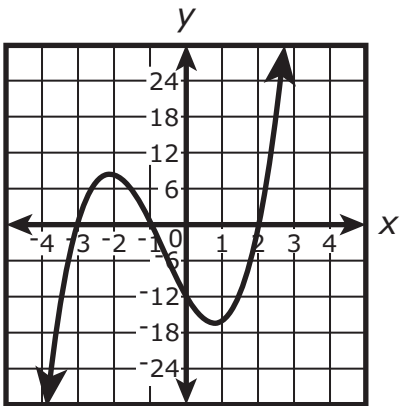
B.



C.



D.



- 13.** This question has two parts.

Consider how to factor this expression **completely**.

$$36ax - 12ay - 3bx + by$$

Part A

What is the first step in factoring the expression?

- A.** Factor out the common factor of 3 from the expression.
- B.** Factor out the common factor of a from the expression.
- C.** Factor out the common factor of b from the expression.
- D.** Factor out the a from the first two terms, and factor out the b from the last two terms.

Part B

Which of these represent the completely factored expression?

Select **all** the correct answers.

- A.** $12a(3x - y) + b(-3x + y)$
- B.** $(3x - y)(12a - b)$
- C.** $(3x - y)(12a + b)$
- D.** $(12a + b)(3x - y)$
- E.** $(12a - b)(3x - y)$

14. This question has two parts.

Keagan is drawing cards from a standard deck of playing cards, which has 52 cards. The cards are separated into 4 suits (clubs, diamonds, hearts, and spades), with an equal number of cards in each suit.

Part A

Keagan draws one card. What is the probability that Keagan draws a diamond or a queen?

A. $\frac{1}{52}$

B. $\frac{1}{13}$

C. $\frac{1}{4}$

D. $\frac{4}{13}$

Part B

Keagan draws a card and then draws another card without putting the first card he drew back in the deck. What is the probability that Keagan draws a spade and then a heart?

A. $\frac{13}{51}$

B. $\frac{1}{4}$

C. $\frac{13}{204}$

D. $\frac{1}{16}$

15. For a statistics project, a group of students collects data to approximate the percentage of people in a city who prefer action movies. The students ask every fifth person entering a movie theater what type of movie they prefer.

- What type of method do the students use to collect the data?
- Which population can conclusions be drawn about based on the method used to collect data? Explain.
- Is the method for collecting data biased? Explain your reasoning.

Enter your answer in the space provided. Show all your work to support your answer.

16. Identify the solutions to the system of equations.

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

What is the y -value of the solution with the least x -value? Round your answer to the nearest hundredth.

Enter your answer in the space.

- 17.** This question has two parts.

Part A

Which formula can be used to calculate the sum of a geometric series with a first term of 8 and a common ratio of 2?

A. $S = a\left(\frac{r^n - 1}{r - 1}\right)$

B. $S = a\left(\frac{1 - r^n}{1 - r}\right)$

C. $S = a\left(\frac{r^n - 1}{1 - r}\right)$

D. $S = a\left(\frac{1 - r^n}{r - 1}\right)$

Part B

Calculate the sum of the geometric series with a first term of 8, a common ratio of 2, and 5 terms.

- 18.** One Pythagorean identity states that $\sin^2 \theta + \cos^2 \theta = 1$.

When $\cos \theta = 1$, what is $\sin \theta$?

Enter your answer in the space.

_____.

19. This question has three parts.

You are a member of your school's student council. The council is considering whether to change the school start time from 8:00 *a.m.* to 8:30 *a.m.* The student council has conducted a survey among the students to gather their opinions on this matter. The survey results are as follows:

- 200 students prefer the start time to remain at 8:00 *a.m.*
- 350 students prefer the start time to change to 8:30 *a.m.*
- 100 students have no preference.

Part A

Identify and record the relevant data from the survey.

Enter your answers in the box.

Part B

Analyze the data by calculating the percentages of students who prefer each start time and those who have no preference. Compare these percentages to determine which start time is most preferred by the students.

Enter your answers, your work, and your explanation in the box.

Part C

Based on your analysis, make a recommendation on whether the school start time should be changed to 8:30 *a.m.* Justify your recommendation by explaining how you used the data to arrive at your conclusion.

Enter your answer, your work, and your explanation in the box.

- 20.** Nika put \$200 in an account that earns 3% interest compounded monthly. No deposits or withdrawals are made. The balance B of the account, in dollars, after t years is represented by $B = 200\left(1 + \frac{0.03}{12}\right)^{12t}$.

- What does $12t$ represent in the function?
- What does $1 + \frac{0.03}{12}$ represent in the function?
- What will be the balance of the account after 10 years? Justify each step in evaluating.

Enter your answers and your work in the box.

- 21.** What is the solution to the rational equation? Write your response as a fraction.

$$\frac{4}{3x - 2} = 2$$

Enter your answer in the space.

- 22.** Solve $2x^4 - 10x^2 + 8 = 0$.

- A.** $x = -4, 4$
- B.** $x = -1, 1$
- C.** $x = -4, -1, 1, 4$
- D.** $x = -2, -1, 1, 2$

23. Kendra solves the equation $5 = \frac{1}{3}(x + 6) - 2$ as shown.

Step 1	$5 = \frac{1}{3}(x + 6) - 2$
Step 2	$\frac{1}{3}(x + 6) - 2 = 5$
Step 3	$\frac{1}{3}(x + 6) = 7$
Step 4	$\frac{1}{3}x + 2 = 7$
Step 5	$\frac{1}{3}x = 5$
Step 6	$x = 15$

Which property can be used to justify the transition from Step 3 to Step 4?

- A. Addition property of equality
 - B. Symmetric property
 - C. Distributive property
 - D. Multiplication property of equality
24. What is the value of the expression $(4 - 3i)(1 + 5i)$?
- A. $4 + 2i$
 - B. $5 + 17i$
 - C. $19 + 17i$
 - D. $19 + 23i$

25. Which expression is equivalent to $\sqrt[3]{\frac{y^2}{y^{\frac{3}{4}}}}$?

A. $y^{\frac{5}{8}}$

B. $y^{\frac{11}{12}}$

C. $y^{\frac{5}{12}}$

D. $y^{\frac{11}{8}}$

26. The rational expression $\frac{3x^3 + 5x^2 - 2x + 7}{x^2 - 4}$ can be rewritten in the form $q(x) + \frac{r(x)}{x^2 - 4}$ by performing polynomial long division. Which set of equations correctly represents $q(x)$ and $r(x)$?

A. $q(x) = 3x + 17, r(x) = 66x + 7$

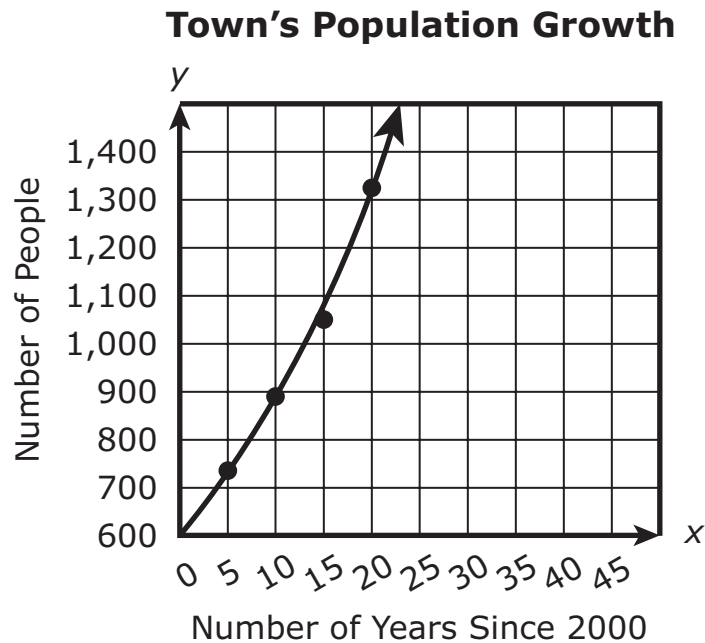
B. $q(x) = 3x + 5, r(x) = 10x + 27$

C. $q(x) = 3x - 7, r(x) = 26x + 7$

D. $q(x) = 3x + 5, r(x) = -14x - 13$

27. This question has two parts.

The scatter plot shows the curve of best fit for the exponential growth of the population of a small town for the years since 2000.



Part A

Use the given points on the graph to determine the equation that represents the curve of best fit.

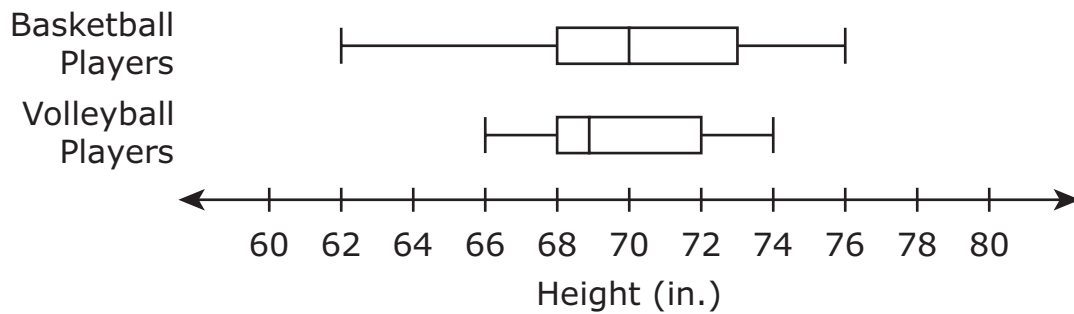
- A.** $y = 130x + 600$
- B.** $y = 160x + 600$
- C.** $y = 600(1.02)^x$
- D.** $y = 600(1.04)^x$

Part B

Use the graph to find the **best** estimate of the population in the year 2025.

- A.** 1,365
- B.** 1,600
- C.** 2,510
- D.** 3,650

- 28.** A researcher is comparing the heights of female college basketball and volleyball players. A simple random sample of 15 subjects from each group was collected. The heights of the subjects are displayed in box plots.



Compare the data in the two box plots.

- How do the median and range of each box plot compare with one another?
- How does the shape of the box plots help compare the two data sets?

Enter your answers and your explanations in the box.





Please let your teacher know that you have completed your test.



