

A.SSE.1a***SELECTED RESPONSE**

Select the correct answer.

1. A clothing store is having a sale in which all T-shirts are \$10. The sales tax is 5%. If Dan buys n T-shirts during this sale, the total cost of his purchase will be $10n + 0.05(10n)$. Interpret the meaning of $0.05(10n)$ in this context.
 - (A) The expression $0.05(10n)$ represents the price of each T-shirt.
 - (B) The expression $0.05(10n)$ represents the cost of Dan's purchase before tax.
 - (C) The expression $0.05(10n)$ represents the total tax on Dan's purchase.
 - (D) The expression $0.05(10n)$ represents the total cost of Dan's purchase.
2. A painter working high on the side of a skyscraper drops his brush from his scaffolding, which is hanging 1024 feet above the ground. The height above the ground of the brush can be modeled by the equation $h = -16t^2 + 1024$, where t is the number of seconds after the brush is dropped and h is the height in feet. Interpret the meaning of $-16t^2$ in this context.
 - (A) The term $-16t^2$ represents the time the brush takes to hit the ground.
 - (B) The term $-16t^2$ represents the initial height of the brush.
 - (C) The term $-16t^2$ represents the height of the brush after t seconds.
 - (D) The term $-16t^2$ represents the distance the brush falls in t seconds.

3. A bacteria culture starts with three cells. Each cell in this culture doubles every hour. After t hours, the number of cells in the culture can be written as $3(2^t)$. Interpret the meaning of 2^t in this context.
 - (A) The factor 2^t is the initial number of cells.
 - (B) The factor 2^t is the number of hours.
 - (C) The factor 2^t is the number of cells in the culture after t hours.
 - (D) The factor 2^t is the number of cells that each original cell in the culture has produced after t hours.

Select all correct answers.

4. A theme park costs \$25.00 to enter. One of the food stands within the park sells hot dogs for \$2.50 each and hamburgers for \$3.50 each. If Paul enters the park, walks to the food stand, and purchases d hot dogs and b hamburgers, the amount of money m he spends can be modeled by the equation $m = 2.5d + 3.5b + 25$. Which of the following are correct interpretations for parts of this equation?
 - (A) $2.5d$ represents the cost of entering the park.
 - (B) $2.5d$ represents the cost of purchasing d hot dogs.
 - (C) $2.5d$ represents the cost of purchasing d hamburgers.
 - (D) $3.5b$ represents the cost of entering the park.
 - (E) $3.5b$ represents the cost of purchasing b hot dogs.
 - (F) $3.5b$ represents the cost of purchasing b hamburgers.
 - (G) 25 represents the cost of entering the park.
 - (H) 25 represents the cost of purchasing d hot dogs and b hamburgers.

CONSTRUCTED RESPONSE

5. A certain vine grows at a rate of three inches per day. A researcher starts observing it when it is 27 inches long.

a. Write an algebraic expression for the length, in feet, of the vine d days after the researcher starts observing it.

b. Interpret both of the factors in the variable term.

c. Interpret the variable term.

6. A full fifty-gallon tank of water has a small leak. Two gallons of water are lost through this leak every day. Write an algebraic expression for the amount of water, in gallons, in the tank after d days and interpret any coefficients in the expression, as well as any variables being multiplied by those coefficients.

7. The volume of a composite figure is $s^3 + (0.5s)^2\pi h$.

a. Interpret what s , s^3 , $0.5s$, and $(0.5s)^2\pi h$ could each represent.

b. Sketch the figure.

8. Part of the water in a pond in a local park was covered by 4 ft^2 of algae. Local residents who frequented the park noticed the area of the pond covered by algae tripled every week. Write an algebraic expression for the area of algae covering the pond after w weeks and interpret the factors of the expression.

A.SSE.1b***SELECTED RESPONSE**

Select the correct answer.

1. Students at a bake sale sell bags of cookies for \$2.25 each and bags of miniature muffins for \$1.50 each. While selling their baked goods, the students also received a \$25 donation. The amount of money the students make from selling c bags of cookies and m bags of muffins can be modeled by the expression $2.25c + 1.5m + 25$. Interpret the expression $2.25c + 1.5m$ in this context.
- (A) The expression $2.25c + 1.5m$ represents the money earned from selling c bags of cookies.
 - (B) The expression $2.25c + 1.5m$ represents the money earned from selling m bags of muffins.
 - (C) The expression $2.25c + 1.5m$ represents the money earned from selling c bags of cookies and m bags of muffins.
 - (D) The expression $2.25c + 1.5m$ represents the money earned from selling one bag of cookies and one bag of muffins.
2. Tatiana deposits \$500 into a bank account that pays 3.25% interest compounded annually. The expression $(1 + 0.0325)^t$ represents the number of dollars in the account after t years for every dollar in the original balance. Which of the following is a reasonable interpretation of the expression $500(1 + 0.0325)^t$ in this context?
- (A) The amount of interest the account earns after 1 year
 - (B) The amount of interest the account earns after 500 years
 - (C) The amount of money in the account after 1 year
 - (D) The amount of money in the account after t years
3. A store is roping off a rectangular area of the floor that needs some repairs. The staff uses 36 feet of rope for this task. Given w is the width of the roped-off floor in feet, interpret $\frac{18 - w}{3}$.
- (A) The width of the roped-off floor in yards
 - (B) The length of the roped-off floor in yards
 - (C) The perimeter of the roped-off floor in yards
 - (D) The area of the roped-off floor in yards

Select all correct answers.

4. Which of the following scenarios give reasonable interpretations of $(1 + 0.05)^t$ in the expression $250(1 + 0.05)^t$?
- (A) Marisa deposits \$250 into a bank account that pays 5% interest compounded annually. After t years, she will have $(1 + 0.05)^t$ dollars in the account.
 - (B) A snake is 250 mm long. It increases in length by 5% every week. After t weeks the snake will be $(1 + 0.05)^t$ times longer.
 - (C) A cell culture has 250 cells, and the population of cells grows at a rate of 5% per day. There were $(1 + 0.05)^t$ cells when the culture first started to grow.
 - (D) A sinkhole is 250 feet deep. Every year, it becomes 5% deeper. After t years, the sinkhole is $(1 + 0.05)^t$ feet deeper.
 - (E) An empty water tank is partially filled with 250 gallons, and the volume of water in the tank increases by 5% each month afterward. After t months, the number of gallons will be increased by a factor of $(1 + 0.05)^t$.

Match each situation with the correct expression.

A local supermarket has a section that serves ready-to-eat food in a buffet style. The section consists of a salad bar, an olive bar, and a wings bar. The salad bar costs \$3.99/lb, the olive bar costs \$6.49/lb, and the wings bar costs \$4.99/lb. Let d be the number of pounds of salad purchased, v the number of pounds of olives, and w the number of pounds of wings. Match the algebraic expressions with their appropriate interpretations in this context.

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| <p>_____ 5. $6.49v + 4.99w$</p> <p>_____ 6. $0.80(3.99d + 4.99w)$</p> <p>_____ 7. $3.99d$</p> <p>_____ 8. $\frac{3.99d + 6.49v}{3}$</p> | <p>A The cost of three people purchasing d pounds of salad</p> <p>B The cost of purchasing d pounds of salad and w pounds of wings, using a 20% off coupon</p> <p>C The cost per person if three people split d pounds of salad and v pounds of olives</p> <p>D The cost of purchasing d pounds of salad and v pounds of olives</p> <p>E The cost of purchasing d pounds of salad and w pounds of wings</p> <p>F The cost of purchasing d pounds of salad</p> <p>G The cost of purchasing v pounds of olives and w pounds of wings</p> |
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CONSTRUCTED RESPONSE

9. A minor league baseball team wants to sell ad space on their outfield wall to local businesses. The team originally thinks about charging \$250 per ad. However, the local businesses know that the more ads there are, the less focus each individual ad will get, so they're not willing to pay as much per ad if they know there will be more of them. The team does market research and finds that they can get \$250 for one ad, \$245 per ad for two ads, \$240 per ad for three ads, and so on. The total revenue from all the outfield banners is calculated using the expression $a(250 - 5(a - 1))$. Interpret what the expression $250 - 5(a - 1)$ represents, and explain your reasoning.

10. Each day, a plant grows to a height that is 20% taller than it was the previous day. The expression $(1 + 0.20)^d$ represents the plant's height after d days if its original height is 1 inch. Another plant with the same growth rate is described by the expression $1.75(1 + 0.20)^d$. Interpret 1.75 in this expression and use this to interpret the entire expression.

A.SSE.2

SELECTED RESPONSE

Select the correct answer.

1. Which of the following is equal to $x^6 - 64$?

- (A) $-64x^6$
- (B) $(x^3 + 8)(x^3 - 8)$
- (C) $(x^3 + 8)^2$
- (D) $(x^3 - 8)^2$

2. What value of a will make the following statement true?

$$5^{3(x-2)} = a5^{3x}$$

- (A) 5^2
- (B) $\frac{1}{5^2}$
- (C) 5^6
- (D) $\frac{1}{5^6}$

3. If Jan jogged $8x - 21$ miles and Julie jogged $24x - 63$ miles, how many times longer was Julie's travel distance than Jan's?

- (A) 3
- (B) 16
- (C) 24
- (D) 63

Select all correct answers.

4. Which of the following expressions can be rewritten as a sum of cubes, a difference of cubes, or a difference of squares?

- (A) $81 - x^4$
- (B) $n^6 + 64$
- (C) $y^5 - 9$
- (D) $25 - 4c^{16}$
- (E) $5p^3 + 27$
- (F) $216 - t^{18}$

5. Which of the following statements present(s) valid reasoning?

- (A) $x^6 + 81$ can be rewritten as $(x^2)^3 + (3)^3$ and factored as a sum of two cubes.
- (B) $49c^2 - 154c + 121$ can be rewritten as $(7c)^2 - 2(7c)(11) + 11^2$ and factored as a perfect square trinomial.
- (C) $36p^4 + 96p + 64$ can be rewritten as $(6p^2)^2 + 2(6p^2)(8) + 8^2$ and factored as a perfect square trinomial.
- (D) $x^4 + 16$ can be rewritten as $(x^2)^2 - (-4)^2$ and factored as a difference of squares.
- (E) $x^{18} - 8$ can be rewritten as $(x^6)^3 - 2^3$ and factored as a difference of cubes.
- (F) $x^9 + 64$ cannot be factored as the sum of two cubes because x^9 is a perfect cube and 64 is a perfect square.

CONSTRUCTED RESPONSE

6. How many binomials can $6561 - 256y^{16}$ be factored into before it is factored completely? Show your work. (Hint: 6561 is 3 raised to a power.)

A.SSE.3a*

SELECTED RESPONSE

Select the correct answer.

- After factoring a quadratic expression that equals zero, which property says that at least one of the factors must equal zero?
 - A The Distributive Property
 - B The Zero Product Property
 - C The Additive Property of Equality
 - D The Multiplicative Property of Equality

Select all correct answers.

- Identify which of the following functions have at least one zero greater than 4.
 - A $w(c) = c^2 + 11c + 30$
 - B $f(x) = x^2 - 5x - 14$
 - C $g(x) = x^2 + 5x - 24$
 - D $v(a) = a^2 - 5a + 6$
 - E $s(t) = t^2 - 3t - 54$
 - F $h(x) = x^2 - 2x - 24$

Factor each quadratic function and match it with the correct description of its zeros.

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| _____ 3. $s(r) = 5r^2 + 49r - 10$ | A One positive zero |
| _____ 4. $k(m) = m^2 - 7m - 18$ | B One negative zero |
| _____ 5. $z(w) = w^2 + 7w + 6$ | C One positive zero and one negative zero, where the positive zero has the larger absolute value |
| _____ 6. $f(x) = 2x^2 - 11x + 12$ | D Two positive zeros |
| | E Two negative zeros |
| | F One positive zero and one negative zero, where the negative zero has the larger absolute value |

CONSTRUCTED RESPONSE

- Identify the zero(s) of $m(n) = n^2 - 23n + 132$ by factoring. Show your work.

- Identify the zero(s) of $f(x) = 3x^2 + 8x - 35$ by factoring. Show your work.

- If $f(x) = x^2 + bx + c$ has two zeros and $c < 0$, explain how you know that one zero must be positive and one zero must be negative.

10. A catapult is used to launch a boulder. The height of the boulder $h(t)$ can be modeled by the function $h(t) = -16t^2 + 64t$, where t is the time in seconds after the boulder is launched. Assuming that the boulder doesn't hit anything, how many seconds after launch will the boulder hit the ground? Show your work.

11. For a publicity stunt, a radio station has a basketball trick shot artist throw a basketball from a studio window to a hoop below. The height of the ball above the hoop, in feet, can be modeled by the function $h(t) = -16t^2 + 4t + 240$, where t is the time in seconds after the ball is thrown. How long after the ball is thrown does it pass through the hoop? Show your work.

12. Assume $f(x) = x^2 + bx + c$ has two zeros, $b > 0$, and $c < 0$.

a. What can you conclude about the signs of the two zeros of the function? Explain your reasoning.

b. What can you conclude about the absolute values of the two zeros? Explain your reasoning.

c. If $b < 0$, how does this change the conclusions from parts a and b? Explain your reasoning.

A.SSE.3b*

SELECTED RESPONSE

Select the correct answer.

- In which quadrant does the minimum of $f(x) = x^2 - 3x - 1$ occur?
 - (A) Quadrant I
 - (B) Quadrant II
 - (C) Quadrant III
 - (D) Quadrant IV
- Which of the following is a true statement about the function $f(x) = x^2 + 5x + 5$?
 - (A) The maximum of the function is $-\frac{5}{4}$.
 - (B) The minimum of the function is $-\frac{5}{4}$.
 - (C) The maximum of the function is $-\frac{5}{2}$.
 - (D) The minimum of the function is $-\frac{5}{2}$.

Select all correct answers.

- Determine which functions have a minimum value that is greater than zero.
 - (A) $f(x) = x^2 - 6x + 5$
 - (B) $f(x) = x^2 + 4x + 7$
 - (C) $f(t) = t^2 + 8t - 10$
 - (D) $f(n) = n^2 + 10n + 11$
 - (E) $f(p) = p^2 - 2p + 8$

Select the correct answer for each lettered part.

- Determine whether or not the maximum of each function is less than the given value.
 - a. $f(x) = -4x^2 + 6x + 5$; 6 Yes No
 - b. $g(c) = -c^2 + 9c - 15$; 7 Yes No
 - c. $f(t) = -4t^2 + 11t - 3$; 5 Yes No
 - d. $g(t) = -9t^2 - 12t - 4$; 0 Yes No

CONSTRUCTED RESPONSE

- Complete the square to find the maximum value of $f(x) = -x^2 + 7x - 11$. Show your work.

- Complete the square to find the minimum value of $f(x) = 2x^2 - 5x + 7$. Show your work.

- Explain why $f(x) = 4x^2 + 5x + c$ has a greater minimum than $g(x) = 9x^2 + 10x + c$ regardless of the value of c .

8. A game store sells a brand of playing cards for \$10. On average, the store sells 100 of these decks per year. The store manager considers raising the price of the decks. The manager expects that for every \$1 increase in price, the store will sell 4 fewer decks per year.

a. Write a function for the gross yearly revenue the manager expects to earn from selling this brand of card deck after x \$1 price increases.

b. Complete the square to determine the maximum yearly revenue the store could earn from selling this brand. Show your work.

c. For how much should the store sell the card decks to earn the maximum yearly revenue? Show your work.

9. A ball is thrown up into the air. Its height h above the ground in feet is modeled by the equation $h = -16t^2 + 24t + 5$, where t is the time in seconds after the ball is thrown. Complete the square to determine the ball's maximum height and the amount of time the ball takes to reach that height. Could this ball land on the roof of a 20-foot-tall building? Show your work.

A.SSE.3c*

SELECTED RESPONSE

Select the correct answer.

- Which of the following is equivalent to the expression $81 \cdot 9^{x+2}$?
 - (A) 81^{x+1}
 - (B) 9^{2x+4}
 - (C) 6561^x
 - (D) 3^{2x+8}
- Which of the following cannot be rewritten in the form $f(x) = 2^{ax}$, where a is an integer?
 - (A) $f(x) = 4^{bx}$, where b is an integer
 - (B) $f(x) = 8^{bx}$, where b is an integer
 - (C) $f(x) = 12^{bx}$, where b is an integer
 - (D) $f(x) = 16^{bx}$, where b is an integer
- A certain radioactive element has a half-life of 35 days. If you had 100 grams of this element, the mass m of the element after t 35-day intervals is represented by $m = 100(0.5)^t$. Find the approximate daily decay rate of this element.
 - (A) 98.0%
 - (B) 17.5%
 - (C) 2.0%
 - (D) 1.4%

Select all correct answers.

- Which of the following are equivalent to $f(x) = 16^x$?
 - (A) $g(x) = 8 \cdot 2^x$
 - (B) $g(x) = 4096 \cdot 16^{x-3}$
 - (C) $g(x) = 4 \cdot 4^x$
 - (D) $g(x) = 0.0625 \cdot 16^{x+1}$
 - (E) $g(x) = 32 \cdot 16^{x-2}$
 - (F) $g(x) = 2 \cdot 8^x$

CONSTRUCTED RESPONSE

- Rewrite $f(x) = 625^{2x}$ as an exponential function with a base of 5.

- How many times greater are the values of the function $g(x) = 3^{x+2}$ than the values of the function $f(x) = 3^x$ for all values of x ? Show your work.

- A certain culture contains 8 bacteria cells. The cell population of the culture doubles in size every hour.
 - Write a function in the form $f(t) = a \cdot b^t$ for the number of cells in the culture after t hours.

 - Write a function $g(t) = d^{pt+q}$ that is equivalent to $f(t)$, where p and q are non-zero integers. Show algebraically that this new function is equivalent to $f(t)$.

8. A certain debt of \$7000 must be repaid with 20% interest compounded annually. The value of the debt D after t years is represented by $D = 7000(1.2)^t$.

- a. Rewrite this function to determine the approximate monthly interest rate of the debt. Show your work and round percent answers to one decimal place.

- b. Rewrite the function from part a to find the approximate bimonthly (every two months) interest rate of the debt. Show your work and round percent answers to one decimal place.

- c. Rewrite the function from part a to find the semiannual interest rate of the debt. Show your work and round percent answers to one decimal place.

9. What is the smallest value of n such that $f(x) = n^x$ can be rewritten as both $f(x) = 4^{ax}$ and $f(x) = 8^{bx}$, where both a and b are positive integers? Justify your answer.
