

3. A quadratic equation $x^2 - 8x + 9 = 0$ is rewritten in the form $(x - p)^2 = q$. What are the values of p and q ?

Scoring Instructions:

$p = 4$ and $q = 7$

OR equivalent

5. Joel has d dimes and q quarters with a total value of \$25.50. Write an equation that represents the total amount **in dollars** in terms of d and q that Joel has.

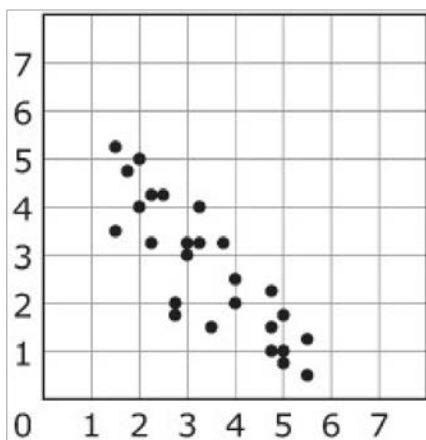
Scoring Instructions:

$0.10d + 0.25q = 25.50$

OR equivalent equation

7. Zuna drew the following scatter plot.

ZUNA'S DATA



Part A. Which family of functions (linear, quadratic, or exponential) would be most appropriate to model the data?

Part B. Give one reason that supports your response.

Scoring Instructions:

Rubric:

- 2 Work demonstrates a **clear and complete** understanding of the mathematical concepts and/or procedures required by the task. Appropriate strategy is shown with clear and complete explanations and interpretations.
- 1 Response demonstrates a **partial** understanding of the mathematical concepts and/or procedures. Appropriate strategy is shown, but explanation or interpretation has minor flaws.

OR

Response is incorrect because of calculation errors. Work and strategy indicate a **clear** understanding of the mathematical concepts and/or procedures required by the task.

- 0 Response is irrelevant, inappropriate, or not provided.

Maximum Points—2

Part A – 1 point

Student responds that a linear function would be most appropriate.

Part B – 1 point

Student gives 1 reason to defend their response.

Sample response

- A linear function would be appropriate because the shape of the data suggests a linear association or straight line.
- The y-values seem to decrease at a relatively constant rate over equal x-intervals.

or other appropriate explanation

9. Factor the expression below.

$$\frac{3}{4}x^2 + \frac{31}{20}x - \frac{3}{5}$$

Scoring Instructions:

$$\left(\frac{x}{4} + \frac{3}{5}\right)(3x - 1)$$

OR equivalent factorization

15. What is the expression $-x^2 + 6x + 2$ written in the form $a(x - h)^2 + k$?

Scoring Instructions:

$$-1(x - 3)^2 + 11$$

17. Let n indicate the position of a term in the sequence below. For example, when $n = 2, f(n) = 4$.

$-2, 4, -8, 16, -32, 64, \dots$

Write an explicit function in terms of n that describes this sequence.

Scoring Instructions:

$$f(n) = (-2)^n$$

OR equivalent function

19. A radioactive element decays by about 50% per day, according to the equation $y = y_0(0.50)^x$, where y represents the amount of the element left after x days and y_0 represents the initial amount of the element.

Part A. Write the equation that can be used to approximate the hourly rate of decay of the element.

Part B. Determine the approximate percentage of the element that decays per hour.

Use words and/or numbers to show your work.

Scoring Rubric:

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- 1 Response demonstrates a **partial** understanding of the mathematical concepts and/or procedures. Appropriate strategy is shown, but explanation or interpretation has minor flaws.

OR

Response is incorrect because of calculation errors. Work and strategy indicate a **clear** understanding of the mathematical concepts and/or procedures required by the task.

- 0 Response is irrelevant, inappropriate, or not provided.

SCORING EXEMPLAR

Maximum Points—2

Part A – [1 point]

- Since the rate of decay per day is represented by the expression $(0.50)^x$, transform this portion of the equation in order to represent the rate per hour.

To find the rate of decay per hour:

Use 1 day = 24 hours to rewrite the expression.

$$\left((0.50)^{\frac{1}{24}} \right)^{24x} \approx (0.97)^{24x}$$

The equation can then be rewritten as $y = y_0(0.97)^{24x}$.

Part B – [1 point]

- The transformed equation reveals that the element decays by a decay factor of $1 - 0.97 = 0.03$, so the approximate equivalent hourly rate of decay is 3% per hour.

OR equivalent work

21. Walker deposits \$500 into a bank account that earns simple interest of 5 % each year. He plans to deposit and save \$150 that he earns mowing lawns at the beginning of each year. Walker's grandma also gives him \$250 a year which he saves, but that is not put into his bank account. Write a function f that represents the amount of money Walker has after x years of saving.

Scoring Instructions:

$$f(x) = 1.05(500 + 150x) + 250x$$

OR equivalent function

23. A model rocket is launched from a high platform at a celebration. The height in meters, h , of the model rocket until it hits the ground is modeled by the expression $h = -4.9x^2 + 19.6x + 24.5$, where x represents the time in seconds after the launch.

Part A. Write the expression in factored form and find the zeros of the function.

Part B. What do the zeros of the function represent in terms of the given context?

Part C. The midpoint of the x -intercepts represents the x -coordinate of the vertex of the function. Using this reasoning, determine how many seconds it will take for the model rocket to reach its **maximum** height.

Part D. What is the **maximum** height of the model rocket after it is launched?

Use words and/or numbers to show your work.

Scoring Instructions:

Rubric:

- 4 Work demonstrates a **clear and complete** understanding of the mathematical concepts and/or procedures required by the task. Appropriate strategy is shown with clear and complete explanations and interpretations.
- 3 Work demonstrates a **clear** understanding of the mathematical concepts and/or procedures but is not complete. Appropriate strategy is shown, but explanation or interpretation has minor flaws.
OR
Response is incorrect because of calculation errors. Work and strategy indicate a **clear** demonstration of the problem.
- 2 Response demonstrates a **partial** understanding of the mathematical concepts and/or procedures. Appropriate strategy is shown, but explanation or interpretation has minor flaws.
- 1 Response shows **minimal** understanding of the mathematical concepts and/or procedures or provides no explanation or interpretation for the solution or shows major flaws.
- 0 Response is irrelevant, inappropriate, or not provided.

SCORING EXEMPLAR

Maximum Points—4

Part A – [1 point]

- $-4.9x^2 + 19.6x + 24.5$

$$-4.9(x^2 - 4x - 5)$$

$$(x + 1)(x - 5) = 0$$

$$x = -1 \text{ or } x = 5$$

Part B – [2 points]

- The solution $x = -1$ makes sense on the graph, because the line crosses the x-axis at -1, but the time of the rocket launch would be 0. So $x = -1$ is an extraneous solution.
The other solution represents that the rocket strikes the ground 5 seconds after the launch.

Part C – [1 point]

- To determine how many seconds it will take for the rocket to reach its maximum height, the x-coordinate of the vertex must be found. This can be done by calculating the mean of x-intercepts.

$$\frac{5 + (-1)}{2} = 2$$

The rocket will reach its maximum height after 2 seconds.

Part D – [1 point]

- The maximum height of the rocket is the y -value of the vertex. This can be found by solving for y using the x -coordinate of the vertex.
 $(-4.9(2)^2 + 19.6 \times 2 + 24.5) = 44.1$ meters

or equivalent work