

4. When the polynomial $3x^2 + 2x + 2$ is divided by $(x - 1)$, the remainder is 7. What would be the constant of the polynomial need to be in order for it to be divisible by $(x - 1)$?

Scoring Instructions:

–5

6. Andy calculates that out of the 100 students that signed up for a charity walk, 60 are juniors, 40 are boys, and 35 are girls who are juniors. What is the probability that a student chosen randomly from the group is either a junior or a girl?

Scoring Instructions:

0.85 or equivalent

9. The time a boat on a river takes to travel a certain distance depends on the speed of the boat in still water and the speed of the current. The function given below represents the time taken by the boat to travel a distance of 60 miles, where 17 is the speed of the boat in still water and r is the average speed of the current, both in miles per hour.

$$T(r) = \frac{60}{17 - r}$$

Positive values of r represent the speed of the current when the boat is going against the current, while negative values of r represent the speed of the current when the boat is going with the current.

Part A. Find the domain of the function. Write your answer in interval notation.

Part B. Interpret the domain in terms of the context. Include in your answer an explanation for any domain values that are undefined.

Use words and/or numbers to show your work.

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.

SCORING EXEMPLAR**Maximum Points—2****Part A – 1 point**

- The domain of $T(r)$ is $(-\infty, 17)$.

or equivalent work

Part B – 1 point

- The vertical asymptote is at $r=17$, which is why the function is undefined for 17. In terms of the context, this represents when the speed of the current is equal to the speed of the boat in still water; at that point, the boat will not be able to move and thus it will take an infinite time to travel any distance. If r is greater than 17, the current will overwhelm the boat.

or equivalent work

10. When $x \geq 1$, what is $(\sqrt[4]{x^2 - 2x + 1})^2$ written in the most simple form of the expression?

Scoring Instructions: $x - 1$ OR $-1 + x$

OR equivalent

13. During low tide, the height of a wave is 2 meters above sea level. During high tide, 6 hours later, the height of the wave is 8 meters above sea level. Assuming a 12-hour cycle, what trigonometric function, using degrees, models the height of the wave, $h(x)$, in terms of time, x , in hours. (Assume that time is 0 at low tide.)

Scoring Instructions:

$$h(x) = -3 \cos(30x) + 5$$

or other appropriate response

16. The function $f(x) = x^2 + 5$ is translated 3 units right and 1 unit up. Write the resulting function, g .

Scoring Instructions:

$$g(x) = (x - 3)^2 + 6$$

or equivalent answer

18. The length of the arc made by a pendulum as it swings freely decreases after every swing. The arc lengths, in millimeters, after the first 3 swings of a certain pendulum are shown below.

729, 243, 81 ...

Write an explicit expression that describes the arc length of the pendulum, in millimeters, after n swings.

Scoring Instructions:

$$729\left(\frac{1}{3}\right)^{n-1}$$

or equivalent expression

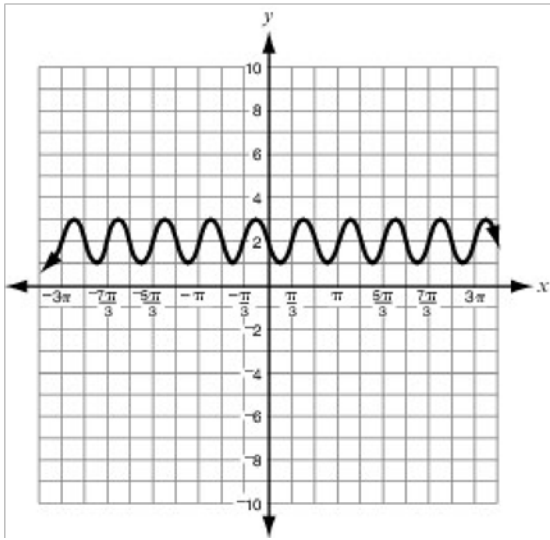
20. What is the solution of the equation

$$\sqrt{3x + 4} = 4?$$

Scoring Instructions:

$$x = 4$$

21. A sinusoidal function is graphed on the coordinate plane below.



What is the period of this graph?

Scoring Instructions:

$$\frac{2\pi}{3}$$

23. During a math test, Charlie is given the equation $4x^2 - 9x + 18 = 0$ and asked to find its discriminant.

Part A. What is the discriminant of the equation? What does this discriminant tell Charlie about the nature of the solutions to the equation?

Part B. Once he finds the discriminant, Charlie is asked to solve the equation. What are the solutions to the equation?

Part C. After solving this equation, Charlie is given a new quadratic equation with real coefficients and is asked to solve it. He determines that there are two solutions, one real root and one imaginary root. Are Charlie's solutions correct? Please explain your answer.

Use words, numbers, and/or pictures to show your work.

Scoring Instructions:**Scoring Exemplar:**

- 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

A correct answer should include:

- Discriminant = $(-9)^2 - 4(4)(18) = -207$. Because the discriminant of the quadratic equation is negative, it has two imaginary solutions.

or equivalent work

$$x = \frac{-(-9) \pm \sqrt{-207}}{(2)(4)} = \frac{9 \pm 3i\sqrt{23}}{8}$$

or equivalent work

- No. A quadratic equation with real coefficients has either two real or two imaginary roots. If one imaginary root of the equation is $a + bi$, then the other root is its conjugate, i.e., $a - bi$.

or equivalent work