

2015 Tenacity Challenge Quiz Bowl Questions

Question #1

2.5 points, 60 seconds

A ball was thrown upward into the air. The height, in feet, of the ball above the ground t seconds after being thrown can be determined by the expression $-16t^2 + 40t + 3$. What is the meaning of the 3 in the expression? Select the correct answer.

- Ⓐ The ball takes 3 seconds to reach its maximum height.
- Ⓑ The ball takes 3 seconds to reach the ground.
- Ⓒ The ball was thrown from a height of 3 feet.
- Ⓓ The ball reaches a maximum height of 3 feet.

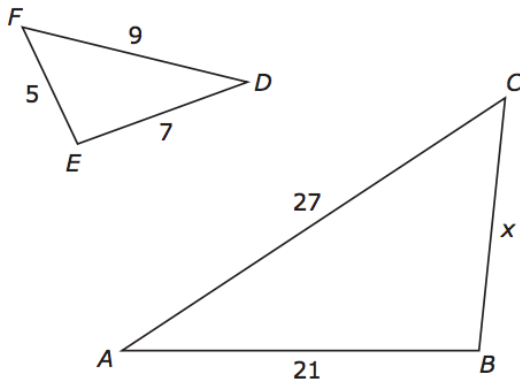
Answer: (C)

2015 Tenacity Challenge Quiz Bowl Questions

Question #2

2.5 points, 60 seconds

The figure shows $\triangle ABC \sim \triangle DEF$ with side lengths as indicated.
What is the value of x ?



Answer: 15

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Question #3

2.5 points, 60 seconds

The cost to manufacture x pairs of sunglasses can be represented by function $C(x)$. If it costs \$398 to manufacture 4 pairs of sunglasses, which of the following is true?

(A) $C(4) = 99.50$

(B) $C(398) = 4$

(C) $C(4) = 398$

(D) $C(99.50) = 1$

Answer: C

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Question 4

5 points, 90 seconds

Given $f(x) = x(x - 1)$, find the coordinates (x, y) of the vertex of $f(x)$.

Answer: $\left(\frac{1}{2}, -\frac{1}{4}\right)$

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Question #5

2.5 points, 120 seconds

A 70-kg astronaut is space-walking outside the space capsule and is stationary when the tether line breaks. As a means of returning to the capsule he throws his 2.0-kg space hammer at a speed of 14 m/s away from the capsule. At what speed does the astronaut move toward the capsule?

- A) 0.40 m/s
- B) 1.5 m/s
- C) 3.5 m/s
- D) 5.0 m/s

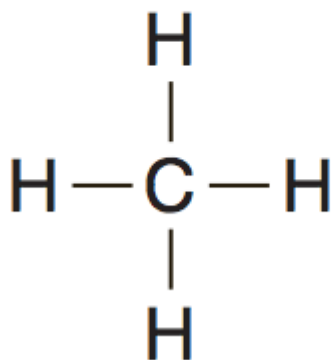
Answer: A

2015 Tenacity Challenge Quiz Bowl Questions

Question #6

2.5 points, 60 seconds

The diagram below represents one molecule of methane (CH₄).



Which of the following is a balanced equation for the synthesis of methane from carbon and hydrogen?

- A. $\text{C} + \text{H} \rightarrow \text{CH}_4$
- B. $\text{C}_4 + \text{H} \rightarrow \text{CH}_4$
- C. $\text{C} + 2\text{H}_2 \rightarrow \text{CH}_4$
- D. $\text{C}_2 + 4\text{H} \rightarrow \text{CH}_4$

Answer: C

2015 Tenacity Challenge Quiz Bowl Questions

Question #7

5 points, 120 seconds

In the equations below, a , b , c , and d are real numbers. Which of the equations could have solutions that are nonreal?

Select **all** that apply.

(A) $ax^2 = b$

(B) $ax^2 + bx = 0$

(C) $ax^2 + bx + c = 0$

(D) $(ax + b)(cx + d) = 0$

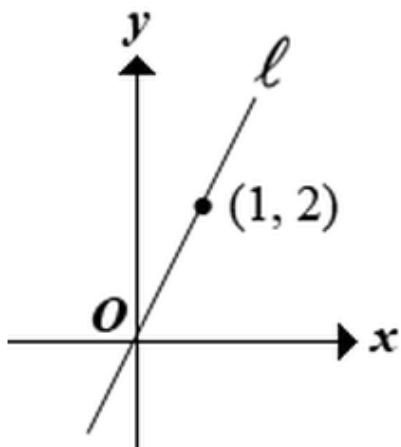
(E) $a(bx + c)^2 = d$

Answer: A, C and E. Need all three correct for credit.

2015 Tenacity Challenge Quiz Bowl Questions

Question #8

2.5 points, 60 seconds



In the xy -coordinate plane above, line l contains the points $(0,0)$ and $(1,2)$. If line m (not shown) contains the point $(0,0)$ and is perpendicular to l , then what is an equation of m ?

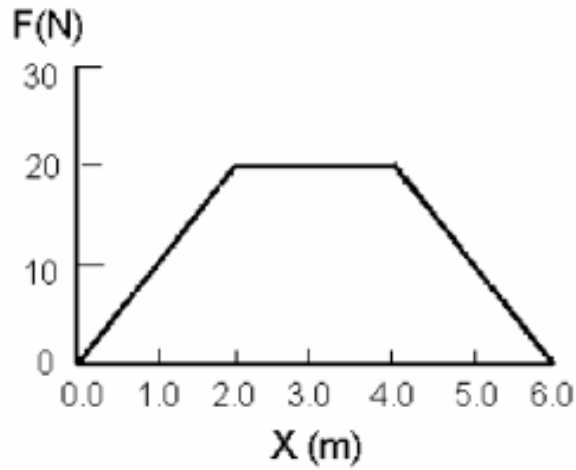
- (A) $y = -\frac{1}{2}x$
- (B) $y = -\frac{1}{2}x + 1$
- (C) $y = -x$
- (D) $y = -x + 2$
- (E) $y = -2x$

Answer: A

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Question #9

5 points, 120 seconds



A force moves an object in the direction of the force. The graph in the above figure shows the force versus the object's position. Find the work done when the object moves from 0 to 2.0 m.

Answer: 20 J

2015 Tenacity Challenge Quiz Bowl Questions

Question #10

2.5 points, 60 seconds

What is the name of the compound with the chemical formula $(\text{NH}_4)_2\text{S}$?

- A. ammonium sulfide
- B. hydrogen sulfate
- C. sulfur hydride
- D. sulfuric acid

Answer: A

2015 Tenacity Challenge Quiz Bowl Questions

Question #11

5 points, 90 seconds

A special lottery is to be held to select the student who will live in the only deluxe room in a college dormitory. There are 100 seniors, 150 juniors, and 200 sophomores who applied. Each senior's name is placed in the lottery 3 times; each junior's name, 2 times; and each sophomore's name, 1 time. What is the probability that a senior's name will be chosen?

(A) $\frac{1}{8}$

(B) $\frac{2}{9}$

(C) $\frac{2}{7}$

(D) $\frac{3}{8}$

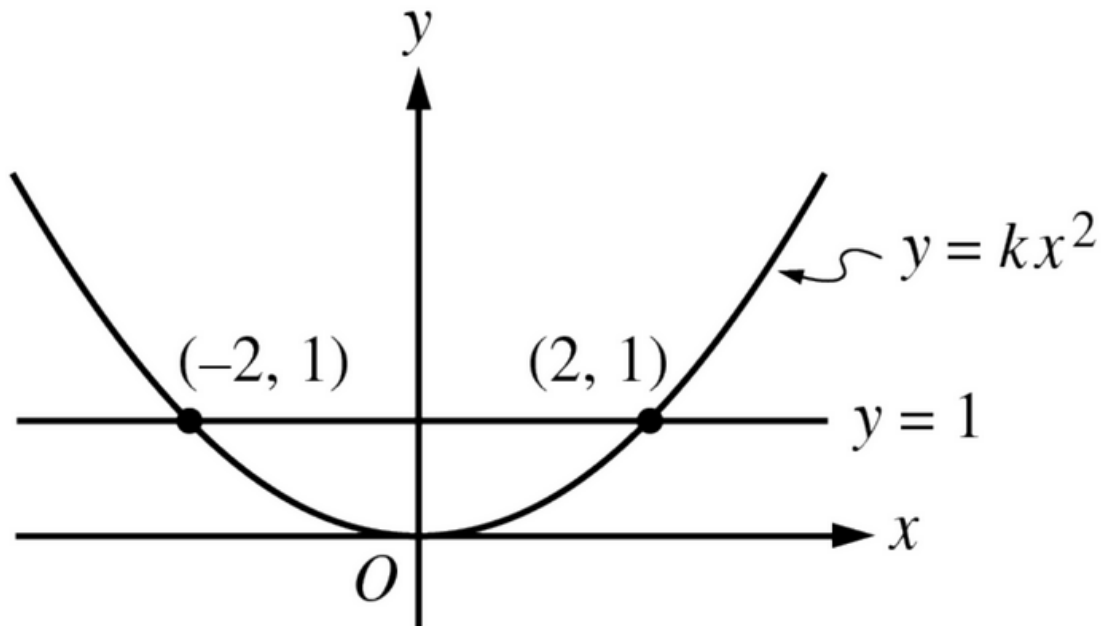
(E) $\frac{1}{2}$

Answer: D

2015 Tenacity Challenge Quiz Bowl Questions

Question #12

10 points, 180 seconds



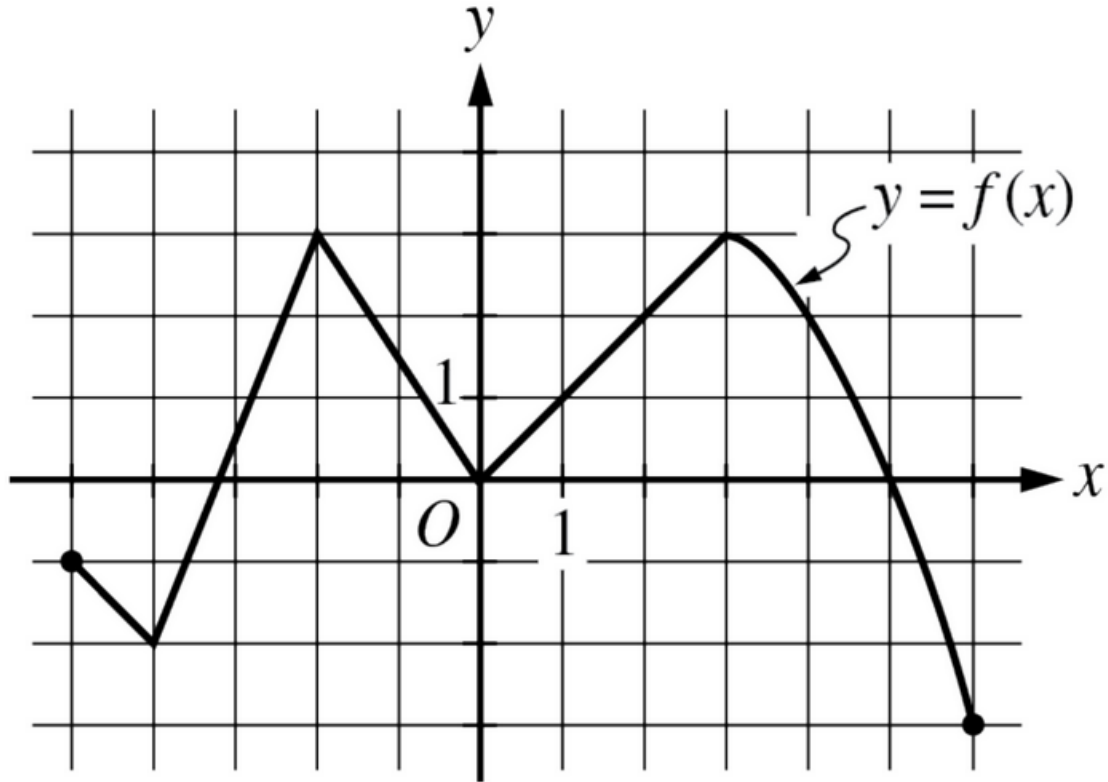
In the xy -plane above, the graphs of $y = 1$ and $y = kx^2$ intersect as shown. What is the value of constant k ?

Answer: $1/4$ or **0.25**

2015 Tenacity Challenge Quiz Bowl Questions

Question #13

10 points, 150 seconds



The graph of the function f is shown in the xy -plane above. The graph of the function g (not shown) is the reflection of the graph of f across the line $y = 4$. What is the value of $g(3)$?

- (A) 3
- (B) 5
- (C) 6
- (D) 7
- (E) 9

Answer: B

2015 Tenacity Challenge Quiz Bowl Questions

Question #14

5 points, 120 seconds

Given $|4x - 7| = 5$ and $|3 - 8x| = 1$, what value of x satisfies both of the equations above?

Answer: 1/2

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Question #15

2.5 points, 60 seconds

For all values of r , let $\star r$ be defined as $\star r = \frac{r+2}{2}$.
If $\star 4 = x$, then $\star x =$

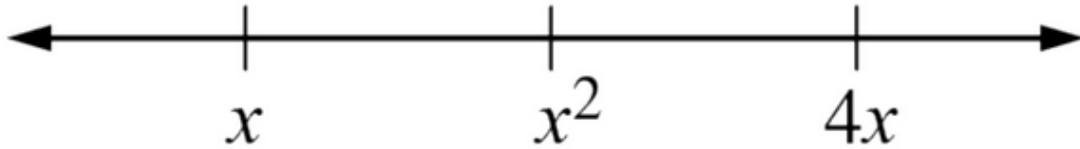
- (A) $\frac{3}{2}$ (B) 2 (C) $\frac{5}{2}$ (D) 3 (E) 4

Answer: C

2015 Tenacity Challenge Quiz Bowl Questions

Question #16

10 points, 150 seconds



On the number line above, the tick marks are equally spaced. If $x > 0$, what is the value of x ?

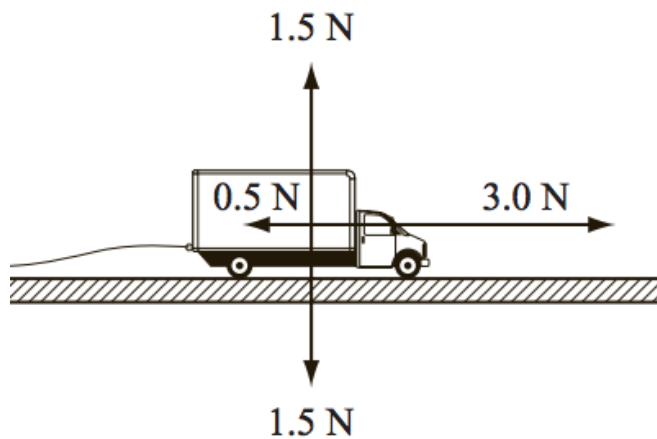
Answer: 2.5 or $5/2$

2015 Tenacity Challenge Quiz Bowl Questions

Question #17

5 points, 90 seconds

A toy truck powered by a battery is accelerating to the right. A string with negligible mass is attached to the truck. The diagram below shows the forces acting on the truck.



If a child pulls the string to the left, what force must the child exert to make the toy truck move to the right at a constant velocity?

- A. 1.0 N
- B. 1.5 N
- C. 2.5 N
- D. 6.0 N

Answer: C

2015 Tenacity Challenge Quiz Bowl Questions

Question #18

2.5 points, 60 seconds

A sample of nitrogen (N_2) gas in a 10.0 L container has a pressure of 1.0 atm at 297 K. Assuming ideal gas behavior, what will the pressure be if the same amount of nitrogen gas is put into a 5.0 L container at 297 K?

- A. 0.40 atm
- B. 0.50 atm
- C. 2.0 atm
- D. 2.5 atm

Answer: C

2015 Tenacity Challenge Quiz Bowl Questions

Question #19

2.5 points, 60 seconds

If $x > 1$ and $\frac{\sqrt{x}}{x^3} = x^m$, what is the value of m ?

(A) $-\frac{7}{2}$

(B) -3

(C) $-\frac{5}{2}$

(D) -2

(E) $\frac{-3}{2}$

Answer: C

2015 Tenacity Challenge Quiz Bowl Questions

Question #20

5 points, 120 seconds

What extraneous solution arises when the equation $\sqrt{x+3} = 2x$ is solved for x by first squaring both sides of the equation?

Answer: Extraneous solution is -0.75 or $-\frac{3}{4}$

2015 Tenacity Challenge Quiz Bowl Questions

Question #21

2.5 points, 60 seconds

If $\frac{x}{y} = \frac{c}{bx}$ and $x = 3$, then what is the value of $\frac{b}{cy}$?

Answer: $\frac{1}{9}$ or .111

2015 Tenacity Challenge Quiz Bowl Questions

Question #22

5 points, 90 seconds

The center of mass of a two-particle system is at the origin. One particle is located at (3.0 m, 0) and has a mass of 2.0 kg. What is the location of the second mass of 3.0 kg?

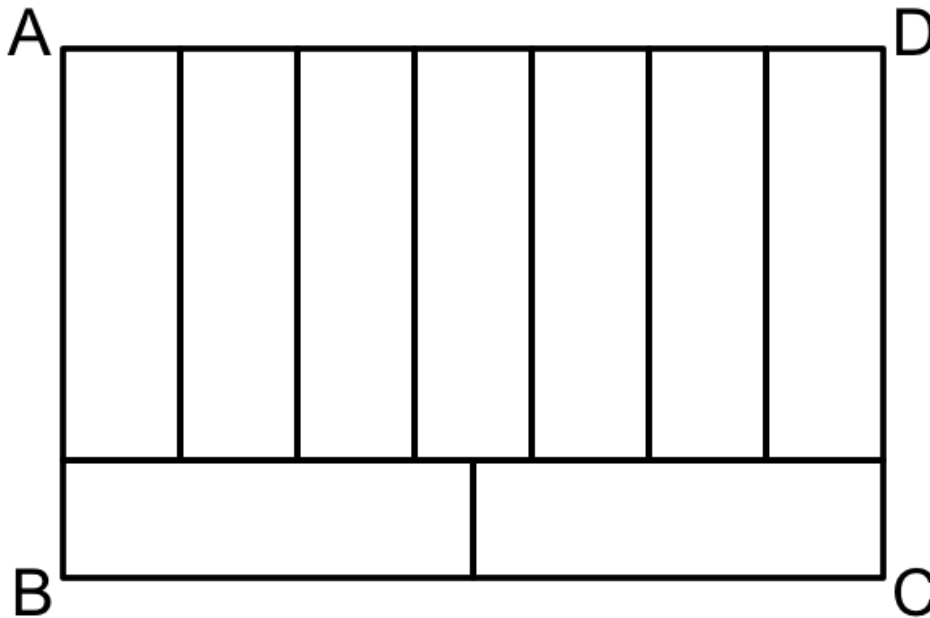
- (A) (-3.0 m, 0)
- (B) (-2.0 m, 0)
- (C) (2.0 m, 0)
- (D) (3.0 m, 0)

Answer: B

2015 Tenacity Challenge Quiz Bowl Questions

Question #23

10 points, 180 seconds



In the diagram, rectangle ABCD has perimeter 184 cm and is divided into nine equal rectangles. Determine the area of rectangle ABCD.

Answer: 2016

2015 Tenacity Challenge Quiz Bowl Questions

Question #24

5 points, 120 seconds

What are **all** of the solutions of the equation $(x^2 + 3)^2 + 21 = 10x^2 + 30$?

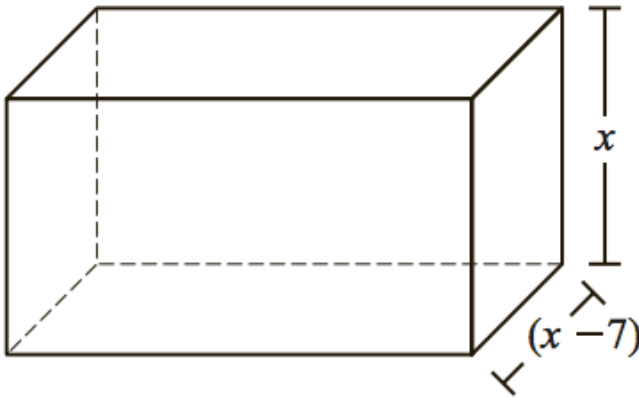
Answer: -2, 0 and 2. Must have all three for credit.

2015 Tenacity Challenge Quiz Bowl Questions

Question #25

5 points, 90 seconds

The height of a right rectangular prism is x centimeters and the width of the prism is $(x - 7)$ centimeters, as shown in the diagram below.



The volume, in cubic centimeters, of the right rectangular prism is represented by the expression $x^3 + 5x^2 - 84x$.

Which of the following expressions represents the length, in centimeters, of the right rectangular prism?

- A. $x^3 - 7$
- B. $x^2 - 7x$
- C. $x + 12$
- D. $x - 12$

Answer: C

2015 Tenacity Challenge Quiz Bowl Questions

Tiebreaker: #1

Solve the system of equations:

$$\begin{cases} \frac{1}{x} + \frac{1}{y} = 3 \\ \frac{2}{x} - \frac{1}{y} = 1 \end{cases}$$

Express your answer in a coordinate pair (x,y) .

Answer: $\left(\frac{3}{4}, \frac{3}{5}\right)$

2015 Tenacity Challenge Quiz Bowl Questions

Tiebreaker: #2

If k is a constant, what is the value of k such that the polynomial $k^2x^3 - 6kx + 9$ is divisible by $x - 1$?

Answer: $k=3$

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Tiebreaker: #3

Consider the equation $\frac{4^{x^2}}{2^x} = 2$.

Which values are solutions to the equation?

Select **all** that apply.

Ⓐ -2

Ⓑ -1

Ⓒ $-\frac{1}{2}$

Ⓓ $\frac{1}{2}$

Ⓔ 1

Ⓕ 2

Answer: C and E

2015 Tenacity Challenge Quiz Bowl Questions

Tiebreaker #4

For the products listed, i represents the imaginary unit. Which of the products are real numbers?

Select **all** that apply.

- Ⓐ $(8 - 2i)(8 + 2i)$
- Ⓑ $(8 - 2i)(5i)$
- Ⓒ $(3)(5i)$
- Ⓓ $(3)(-4)$
- Ⓔ $(i)(8 + 2i)$
- Ⓕ $(i)(5i)$

Answer: A, D and F

2015 Tenacity Challenge Quiz Bowl Questions

Tiebreaker #5

Consider the equation $(x^2 + 2xy + y^2)(x + y) = 64$.

7. Part A

What is the value of $x + y$?

- Ⓐ 2
- Ⓑ 4
- Ⓒ 8
- Ⓓ 32

Part B

If $z > 0$ and $z^x z^y = 81$, what is the value of z ?

Answer: B and then 3 for Part B

2015 Tenacity Challenge Quiz Bowl Questions

Tiebreaker #6 Sudden Death

Given that a , b , and c are non-zero real numbers, define $(a, b, c) = \frac{a}{b} + \frac{b}{c} + \frac{c}{a}$. Find $(2, 12, 9)$.

- (A) 4 (B) 5 (C) 6 (D) 7 (E) 8

Answer: C

2015 Tenacity Challenge Quiz Bowl Questions

Tiebreaker #7 Sudden Death

Simplify

$$\sqrt[3]{x\sqrt[3]{x\sqrt[3]{x\sqrt{x}}}}$$

- (A) \sqrt{x} (B) $\sqrt[3]{x^2}$ (C) $\sqrt[27]{x^2}$ (D) $\sqrt[54]{x}$ (E) $\sqrt[81]{x^{80}}$

Answer: A

2015 Tenacity Challenge Quiz Bowl Questions

Tiebreaker #8 Sudden Death

What is the sum of all of the roots of $(2x + 3)(x - 4) + (2x + 3)(x - 6) = 0$?

- (A) $7/2$ (B) 4 (C) 5 (D) 7 (E) 13

Answer: A

2015 Tenacity Challenge Quiz Bowl Questions

Tiebreaker #9 Sudden Death

The equations $2x + 7 = 3$ and $bx - 10 = -2$ have the same solution x . What is the value of b ?

- (A) -8 (B) -4 (C) -2 (D) 4 (E) 8

Answer: B

2015 Tenacity Challenge Quiz Bowl Questions

Tiebreaker #10 Sudden Death

A parabola with equation $y = x^2 + bx + c$ passes through the points $(2, 3)$ and $(4, 3)$. What is c ?

- (A) 2 (B) 5 (C) 7 (D) 10 (E) 11

Answer: E