

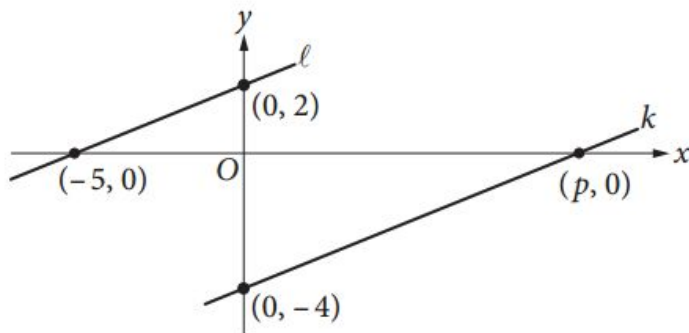
2016 Tenacity Challenge Quiz Bowl



Question #1

5 points

120 Seconds



In the xy -plane above, line ℓ is parallel to line k .
What is the value of p ?

- A) 4
- B) 5
- C) 8
- D) 10



Question #1

Answer: D

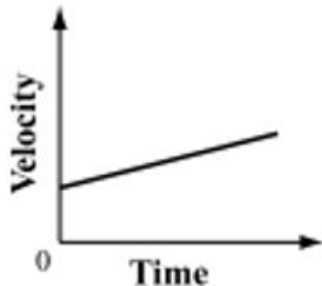
Question #2

2.5 points

60 Seconds

The graph below represents the motion of a car.

Velocity vs. Time



Based on the graph, which of the following statements describes the motion of the car?

- A. The car initially travels at a constant speed and then stops.
- B. The car starts from rest and then travels at a constant speed.
- C. The car starts from rest and then accelerates at a constant rate.
- D. The car is initially moving and then accelerates at a constant rate.



Question # 2

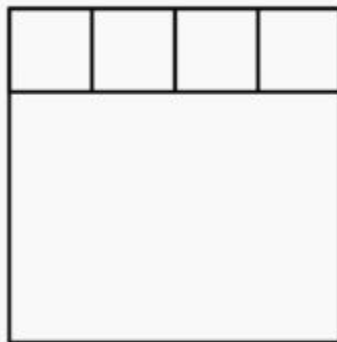
Answer: D

Question #3

10 points

180 Seconds

Four identical squares and one rectangle are placed together to form one large square as shown. The length of the rectangle is how many times as large as its width?



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



Question #3

Answer: B



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Question #4

5 points

120 Seconds

The mean, median, and mode of the 7 data values 60, 100, x , 40, 50, 200, 90 are all equal to x . What is the value of x ?

- (A) 50 (B) 60 (C) 75 (D) 90 (E) 100



Question #4

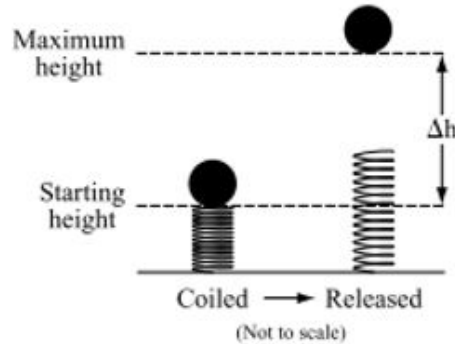
Answer: D

Question #5

5 points

120 Seconds

A 0.5 kg sphere is placed on top of a coiled spring. The coiled spring has 30 J of elastic potential energy. When the spring is released, the sphere moves upward, as shown in the diagram below.



Neglecting friction and the mass of the spring, what is the change in height (Δh) of the sphere?

- A. 1.5 m
- B. 5.0 m
- C. 6.0 m
- D. 15.0 m



Question # 5

Answer: C



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Question #6

2.5 points

60 Seconds

If $\frac{t+5}{t-5} = 10$, what is the value of t ?

A) $\frac{45}{11}$

B) 5

C) $\frac{11}{2}$

D) $\frac{55}{9}$



Question #6

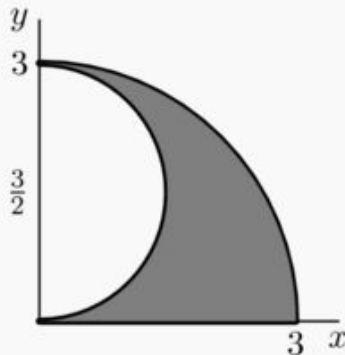
Answer: D

Question #7

10 points

150 Seconds

The shaded region below is called a shark's fin falcata, a figure studied by Leonardo da Vinci. It is bounded by the portion of the circle of radius 3 and center $(0, 0)$ that lies in the first quadrant, the portion of the circle with radius $\frac{3}{2}$ and center $(0, \frac{3}{2})$ that lies in the first quadrant, and the line segment from $(0, 0)$ to $(3, 0)$. What is the area of the shark's fin falcata?



- (A) $\frac{4\pi}{5}$ (B) $\frac{9\pi}{8}$ (C) $\frac{4\pi}{3}$ (D) $\frac{7\pi}{5}$ (E) $\frac{3\pi}{2}$



Question #7

Answer: B



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Question #8

2.5 points

60 Seconds

A 8.0L balloon is carried from the top of a mountain where the pressure is 0.80 atm to the bottom of the mountain where the pressure is 1.2 atm. Assuming constant temperature, what is the volume of the balloon at the bottom of the mountain?

- A. 0.12 L
- B. 5.3 L
- C. 7.7 L
- D. 12 L



Question #8

Answer: B

Question #9

5 points

90 Seconds

$$h = -16t^2 + vt + k$$

The equation above gives the height h , in feet, of a ball t seconds after it is thrown straight up with an initial speed of v feet per second from a height of k feet. Which of the following gives v in terms of h , t , and k ?

A) $v = h + k - 16t$

B) $v = \frac{h - k + 16}{t}$

C) $v = \frac{h + k}{t} - 16t$

D) $v = \frac{h - k}{t} + 16t$



Question #9

Answer: D



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Question #10

10 points

180 Seconds

The second term of a geometric sequence is 12, and the sixth term is $1024/27$. Find the first term.



Question #10

Answer: 9 or -9 [either accepted]



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Question #11

5 points

120 Seconds

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

What is the sum of the positive solutions of the equation above?



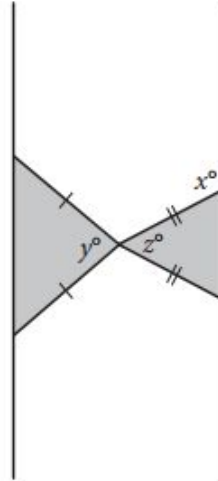
Question #11

Answer: 3

Question #12

5 points

90 Seconds



Note: Figure not drawn to scale.

Two isosceles triangles are shown above. If $180 - z = 2y$ and $y = 75$, what is the value of x ?



Question #12

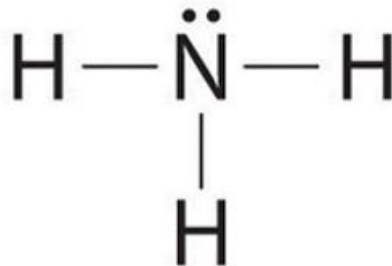
Answer: 105 degrees

Question #13

2.5 points

60 Seconds

The diagram below represents one molecule of ammonia (NH₃)



Which of the following is a balanced equation for the synthesis of ammonia from nitrogen and hydrogen?

- A. $\text{N} + 3\text{H} \rightarrow \text{NH}_3$
- B. $\text{N} + \text{H}_3 \rightarrow \text{NH}_3$
- C. $2\text{N} + 3\text{H}_2 \rightarrow 2\text{NH}_3$
- D. $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$



Question # 13

Answer: D



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Question #14

10 points

150 Seconds

$$b = 2.35 + 0.25x$$

$$c = 1.75 + 0.40x$$

In the equations above, b and c represent the price per pound, in dollars, of beef and chicken, respectively, x weeks after July 1 during last summer. What was the price per pound of beef when it was equal to the price per pound of chicken?

- A) \$2.60
- B) \$2.85
- C) \$2.95
- D) \$3.35



Question #14

Answer: D



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Question #15

5 points

90 Seconds

Two charge separated a distance of 1 meter exert a 1 N force on each other. If the charges are pulled to a 2 meter separation distance, the force on each charge will be _____.

- a) 0.5 N
- b) 0.25 N
- c) 0 N
- d) 2 N
- e) 4 N



Question #15

Answer: B



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Question # 16

10 points

150 Seconds

The complete set of x -values satisfying the inequality $(x^2 - 4)(x^2 - 9) > 0$



Question #16

Answer: $x < -3$, $-2 < x < 2$, and $x > 3$

Must have all three parts for credit.

Question #17

5 points

120 Seconds

Suppose $A > B > 0$ and A is $x\%$ greater than B . What is x ?

- (A) $100\left(\frac{A-B}{B}\right)$ (B) $100\left(\frac{A+B}{B}\right)$ (C) $100\left(\frac{A+B}{A}\right)$ (D) $100\left(\frac{A-B}{A}\right)$



Question # 17

Answer: A



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Question #18

10 points

150 Seconds

A number is 1 more than half of its opposite. Compute the reciprocal of this number.



Question #18

Answer: $3/2$ or 1.5



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Question #19

10 points

150 Seconds

A company that manufactures memory chips for digital cameras uses the formula $c = 3\sqrt{n} (40\sqrt[6]{n} + 9\sqrt[4]{n})$ to determine the cost, c , in dollars, for producing n chips. This formula can be written as $c = 120\sqrt[3]{n^a} + 27\sqrt[4]{n^b}$, where a and b are constants. What are the values of a and b ?

Enter your answers in the boxes.

$a =$, $b =$



Question #19

Answer: $a=2$ and $b=3$

NO PARTIAL CREDIT

Question #20

5 points

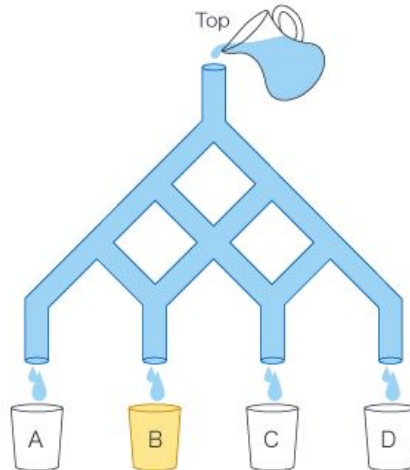
120 Seconds

Water Pipes

You are pouring water into the top of some water pipes as shown below.

When water comes to a separating point, it divides into halves and flows into two branches.

After pouring some water into the top, you got one liter of water in D. How many liter(s) of water flowed into B?





Question # 20

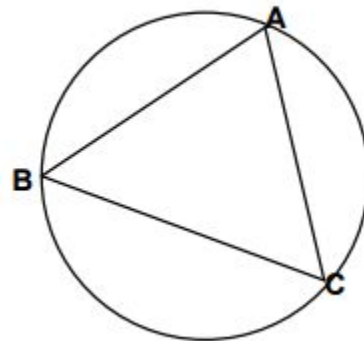
Answer: 3L

Question #21

10 points

150 Seconds

Given: $m\angle A = 8x - 2$, $m\angle B = 4x + 2$ and minor arc $\widehat{AC} = 9x - 3$
Find $m\angle C$.





Question #21

Answer: 96 degrees

Tiebreaker #1 NO CALCULATOR

What is the value of $\frac{11! - 10!}{9!}$?

- (A) 99 (B) 100 (C) 110 (D) 121 (E) 132



Question #1

Answer: B



Tiebreaker #2

A football game was played between two teams, the Cougars and the Panthers. The two teams scored a total of 34 points, and the Cougars won by a margin of 14 points. How many points did the Panthers score?

- (A) 10 (B) 14 (C) 17 (D) 20 (E) 24

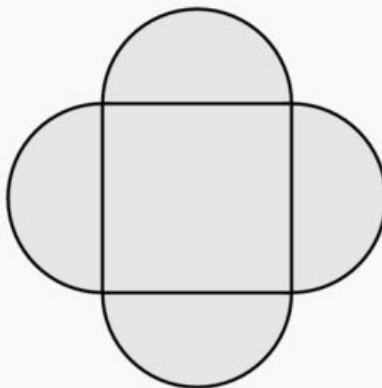


Question #2

Answer:A

Tie breaker #3

A region is bounded by semicircular arcs constructed on the side of a square whose sides measure $\frac{2}{\pi}$, as shown.
What is the perimeter of this region?



- (A) $\frac{4}{\pi}$ (B) 2 (C) $\frac{8}{\pi}$ (D) 4 (E) $\frac{16}{\pi}$



Question #3

Answer: D

Tie breaker #4

What is $10 \cdot \left(\frac{1}{2} + \frac{1}{5} + \frac{1}{10}\right)^{-1}$?

- (A) 3 (B) 8 (C) $\frac{25}{2}$ (D) $\frac{170}{3}$ (E) 170



Question #4

Answer: C

Tie breaker #5 (NO CALCULATOR)

Which of the following is equal to $1 + \frac{1}{1 + \frac{1}{1+1}}$?

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

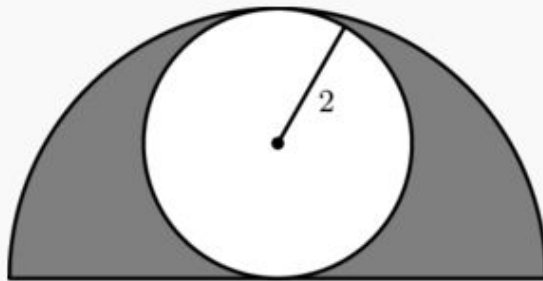


Question #5

Answer: C

Tie breaker #6

A circle of radius 2 is inscribed in a semicircle, as shown. The area inside the semicircle but outside the circle is shaded. What fraction of the semicircle's area is shaded?



- (A) $\frac{1}{2}$ (B) $\frac{\pi}{6}$ (C) $\frac{2}{\pi}$ (D) $\frac{2}{3}$ (E) $\frac{3}{\pi}$



Question # 6

Answer: A

Tie breaker #7

What non-zero real value for x satisfies $(7x)^{14} = (14x)^7$?

- (A) $\frac{1}{7}$ (B) $\frac{2}{7}$ (C) 1 (D) 7 (E) 14



Question #7

Answer: B



Tie breaker #8

The point in the xy -plane with coordinates $(1000, 2012)$ is reflected across the line $y = 2000$. What are the coordinates of the reflected point?

- (A) $(998, 2012)$ (B) $(1000, 1988)$ (C) $(1000, 2024)$ (D) $(1000, 4012)$ (E) $(1012, 2012)$



Question # 8

Answer: B

Tie breaker #9 (No Calculator)

For the nonzero numbers a , b , and c , define

$$(a, b, c) = \frac{abc}{a + b + c}$$

Find $(2, 4, 6)$.

- (A) 1 (B) 2 (C) 4 (D) 6 (E) 24



Question # 9

Answer: C



Tie breaker #10

For some positive constant A , if $x = 1$ is a solution of the equation $|x - A| = 5$, what is the other solution?



Question # 10

Answer: 11