AUA e-Math Test C

Sample Questions

Question 1

Consider a number such that the quotient of seven less than twelve times the number and 5 is 13. What is the number?

A. 8

B. 7

C. 4

D. 5

E. 6

Question 2

Which of the following points is a solution to $y>\frac{1}{2}x-8$?

A. (4,-8)

B. (20,0)

C. (20,1)

D. (4,2)

E. (18,1)

Question 3

What curve is given by the equation $\frac{x^2}{9}+y^2=1$?

A. Ellipse with horizontal major axis

B. Ellipse with vertical major axis

C. Hyperbola intersecting the x-axis

D. Hyperbola intersecting the y-axis

E. None of the above

Question 4

Allison, Jonathan, and Jennifer are teachers at a school. There classes contain a total of 82 students. Jonathan's class is 25% larger than Jennifer's class. Allison's class has 9 more students than Jennifer's class. How many students are in Allison's class?

A. 35 students

B. 26 students

C. 31 students

D. 14 students

E. 25 students

Question 5

Let L be the line through the points (0,0) and (3,1). Let M be the line through (10,0) perpendicular to line L. What is the x-coordinate of the point where L and M intersect?

A. 9

B. -10

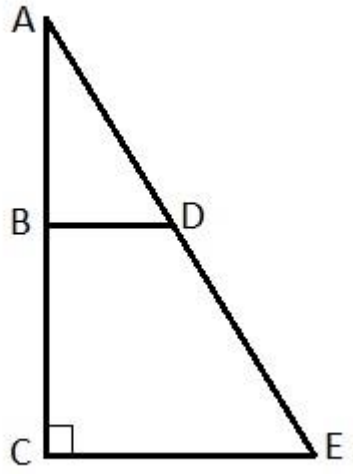
C. -9

D. 45

E. 11

Question 6

The triangle ACE is a right triangle, and the segments BD and CE are parallel. If the lengths of AB, BC, and AD are 3, 9, and 5 respectively, how long is segment AE?



A. 20

B. 15

C. 10

D. 25

E. 30

Question 7

A university has three libraries: a general studies library, a sciences library, and a special collections library. In total, the three libraries have a total of 1400000 books. The general studies library has twice as many books as the sciences library. The special collections library has 200000 fewer books than the sciences library. How many books are there in the special collections library?

A. 200000 books

B. 400000 books

C. 500000 books

D. 440000 books

E. 300000 books

Question 8

Let $f(x) = x^2 + 6x + 9$, and let $g(x)$ be the inverse of $f(x)$. What is $g(16)$?

A. $\sqrt{13}$

B. 4

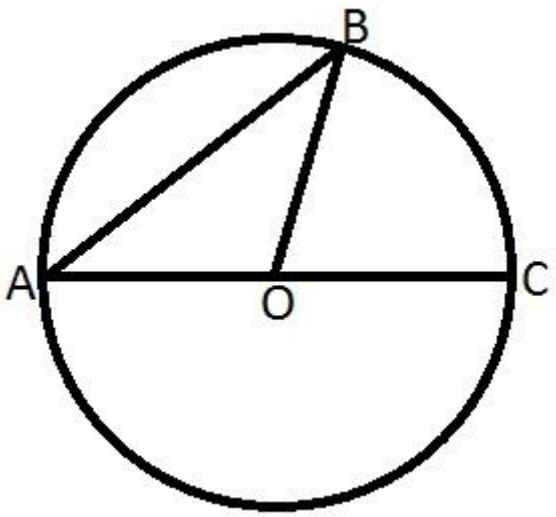
C. $\sqrt{19}$

D. 1

E. 3

Question 9

In the figure, segment AC is a diameter of the circle centered at O, and A, B, and C are all points on the circle. If the measure of angle B is 60 degrees, and the length of AC is 18, what is the length of the minor arc BC?



A. 6π

B. 12π

C. 3π

D. 18π

E. $\frac{1}{2\pi}$

Question 10

A biologist is comparing the behavior of three species of slime mold. She begins with three separate samples, covering a total area of 75 cm^2. Species A has an expansion rate of 20% per week, species B has an expansion rate of 25% per week, and species C has an expansion rate of 15%. After one week, the total surface area of the three species is 89 cm^2. Species A begins with a surface area of 5 cm^2 less than species B. What is the starting surface area of species C?

A. 15 cm^2

B. 37 cm^2

C. 40 cm^2

D. 22 cm^2

E. 25 cm^2

Question 11

Solve $8^{(x-3)} = 6$ for x.

A. $\frac{(\log_2(3)+3)}{3}$

B. $\frac{(10+\log_2(3))}{3}$

C. $\log_2(3) + 1$

D. $\log_2(3) + 3$

E. $\log_2(3) + 2$

Question 12

A ship travels 800 km in 8 hours, and makes the return trip in 16 hours. Assuming a constant speed a direction for the current, and a constant speed for the ship, how fast is the current?

A. 75 km/h

B. 50 km/h

C. 25 km/h

D. 15 km/h

E. 20 km/h

Question 13

Solve $8^{(x+1)} = 4$ for x.

A. 1

B. 2

C. -1

D. $-\frac{1}{2}$

E. $-\frac{1}{3}$

Question 14

Compute "a" for the parabola $y = (a)x^2 + 7x - 15$ that passes through the point (1,-6)

A. -2

B. 3

C. -1

D. 1

E. 2

Question 15

Let $f(x) = \tan(2x - \frac{\pi}{4})$. What is the period of $f(x)$?

A. $\frac{\pi}{2}$

B. 2π

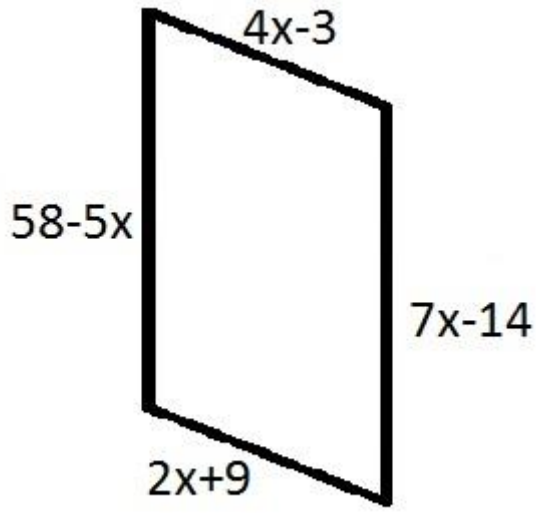
C. $\frac{3\pi}{4}$

D. 3π

E. $\frac{\pi}{4}$

Question 16

In the figure, ABCD is a parallelogram with the indicated side lengths for some number x. What is the perimeter of ABCD?



A. 120

B. 106

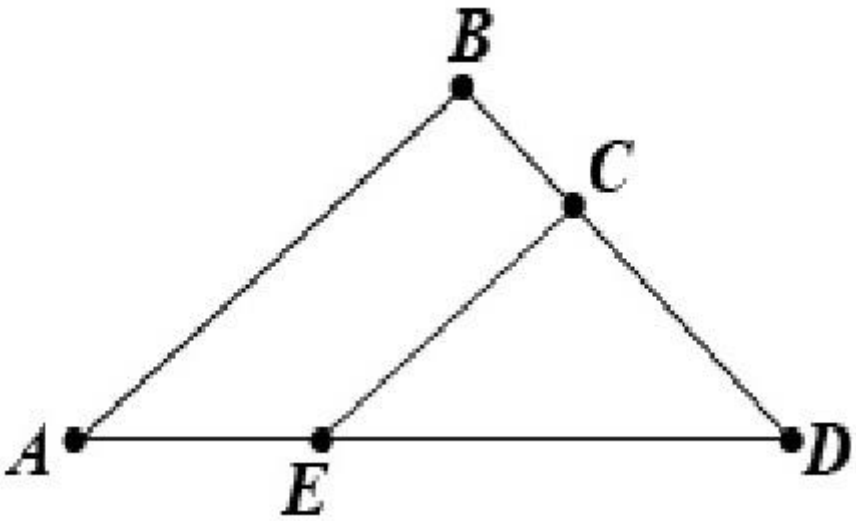
C. 98

D. 90

E. 108

Question 17

In the figure, the triangles ABD and ECD are similar, and the ratio of the length of segment AD to the length of segment ED is 9 to 4. What is the ratio of the area of triangle ABD to the area of triangle ECD?



A. 81 to 16

B. 9 to 4

C. 3 to 2

D. 18 to 8

E. 16 to 10

Question 18

A restaurant offers two different lunch options, a sandwich or a salad. On Sunday, the restaurant sells 12 sandwiches and 3 salads totaling $132. On Monday, the restaurant sells 8 sandwiches and 9 salads, totaling $144. What is the price of a sandwich?

A. $9

B. $8

C. $15

D. $3

E. $10

Question 19

If $\log_{10} 2 = 0.3010$ and $\log_{10} 9 = 0.9542$, what is the value of $\log_{90} 144$?

A. 2.2619

B. 1.1044

C. 0.5960

D. 1.8109

E. 0.4894

Question 20

Which of the following is a unit vector in the same direction as (-4,3)?

A. $\left(-\frac{4}{25}, \frac{3}{25}\right)$

B. $\left(-\frac{4}{7}, \frac{3}{7}\right)$

C. $\left(-\frac{4}{49}, \frac{3}{49}\right)$

D. $\left(-\frac{4}{5}, \frac{3}{5}\right)$

E. $\left(-\frac{4}{38}, \frac{3}{49}\right)$

Question 21

Let P be the set of all integer multiples of 5, and let a and b be elements of P. Which of the following may not be an element of P?

A. a-b

B. ab

C. a^2-b^2

D. $(ab)^2$

E. None of the above

Question 22

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Suppose $\cos(\theta) = \frac{5}{13}$. What is $\tan(\theta - \left(\frac{\pi}{2}\right))$?

A. $\frac{-5}{13}$

B. $\frac{5}{12}$

C. $\frac{-5}{14}$

D. $\frac{-5}{12}$

E. $\frac{5}{13}$

Question 23

What is the solution set of $x^2 - 4x + 3 = 0$?

A. {1}

B. {-1, -3}

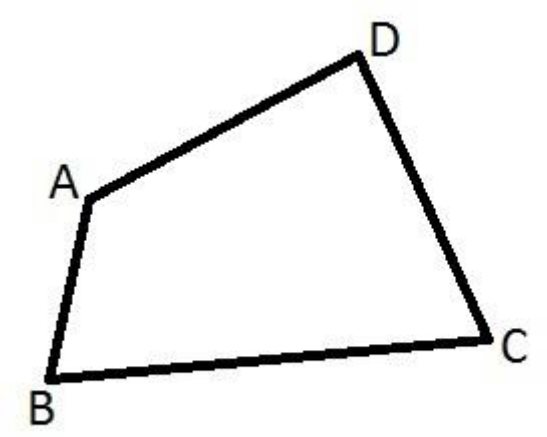
C. {1, 3}

D. {-3}

E. {3}

Question 24

In the figure, ABCD is a quadrilateral, angle D is a right angle, angle B is one third larger than angle A, and angle C is 20 degrees larger than angle A. What is the measure of angle C?



A. 100 degrees

B. 95 degrees

C. 67 degrees

D. 120 degrees

E. 54 degrees

Question 25

Let $\underset{a}{\rightarrow}$ and $\underset{b}{\rightarrow}$ be two vectors such that their magnitudes are 1 and 2 respectively, and the scalar product $\underset{a}{\rightarrow} * \underset{b}{\rightarrow} = 1$.

Find the angle between $\underset{a}{\rightarrow}$ and $\underset{b}{\rightarrow}$.

A. $\frac{\pi}{3}$

B. $\frac{\pi}{6}$

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

D. $\frac{\pi}{2}$

E. π

Question 26

Let $f(x) = x^3 - 2x^2 - 23x + k$, and let a, b, and c be the roots of $f(x) = 0$. What is the value of $a^2+b^2+c^2$?

A. 4

B. 50

C. 46

D. 54

E. 25

Question 27

If $\tan(\theta) = \frac{24}{7}$, compute $\cos(2\theta)$, where $0 \leq \theta \leq \frac{\pi}{2}$

A. $\frac{-527}{625}$

B. $\frac{336}{625}$

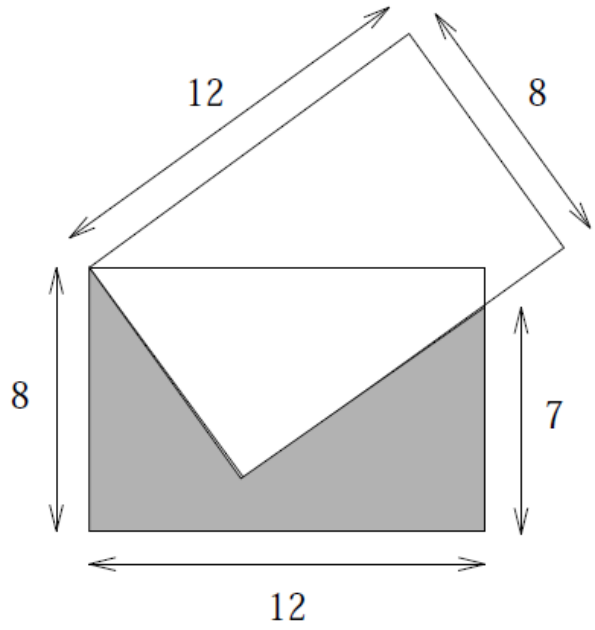
C. $\frac{527}{625}$

D. $\frac{-336}{625}$

E. $\frac{228}{625}$

Question 28

Let two 8x12 rectangles share a common corner and overlap. The distance from the bottom right corner of one rectangle to the intersection point along the right edge of that rectangle is 7. What is the area of the shaded region?



A. 36

B. 45

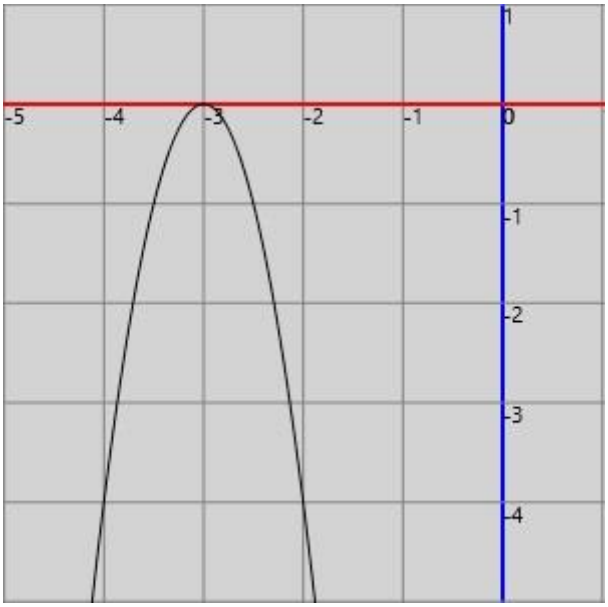
C. 48

D. 54

E. 56

Question 29

Suppose $f(x) = -4x^2 + bx - 36$ for some real number b, part of which is graphed in the figure. What is the value of $f(1)$?



A. -64

B. -32

C. 12

D. -24

E. 24

Question 30

If $xy > 0$, the expression $\log(2xy)$ is equivalent to

A. $2(log\ x\ +\ log\ y)$

B. $2(log\ x)(log\ y)$

C. $2log\ x\ +\ log\ y$

D. $log2\ +\ log\ x\ +\ log\ y$

E. $log\ x\ +\ 2log\ y$

Question 31

What is the smallest positive zero of the function $y = 78\cot(\frac{7x}{5})$?

A. $\frac{14\pi}{5}$

B. $\frac{7\pi}{5}$

C. $\frac{5\pi}{7}$

D. $\frac{5\pi}{14}$

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

Question 32

Simplify the expression $\sqrt{(9+3\times\sqrt{5})}-\sqrt{(9-3\times\sqrt{5})}$.

A. $5\times\sqrt{6}$

B. $2\times\sqrt{39}$

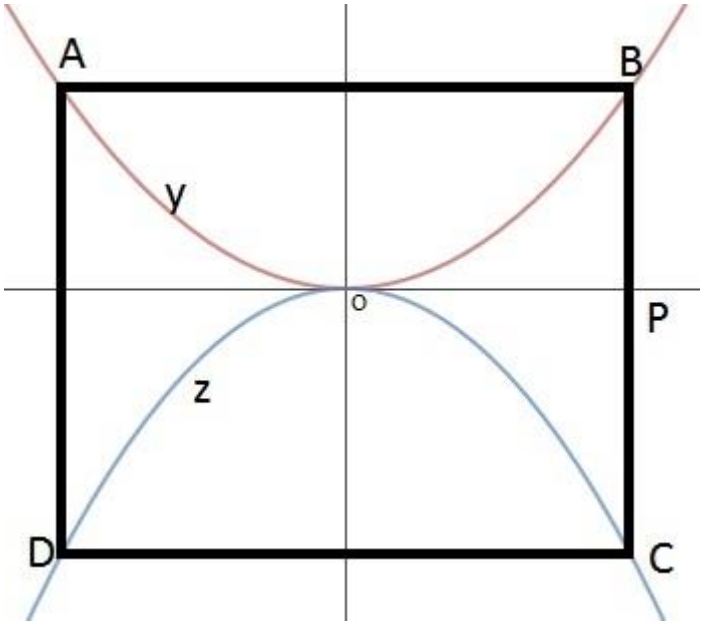
C. $2\times\sqrt{3}$

D. $5\times\sqrt{3}$

E. $\sqrt{6}$

Question 33

In the figure, the curves $y=px^2$ and $z=qx^2$ intersect rectangle ABCD at its four vertices. Point P has coordinates $(\frac{1}{2},0)$. Which of the following expressions gives the area of the rectangle?



A. $\frac{(p-q)}{8}$

B. $\frac{(p+q)}{2}$

C. $\frac{(p+q)}{4}$

D. $\frac{(p+q)}{8}$

E. $\frac{(p-q)}{4}$

Question 34

Assuming $c \neq 0$, solve for x if $a = \frac{b}{10^{cx}}$

A. $x = \frac{b10^c}{a}$

B. $x = \frac{\log_{10}(a)-\log_{10}(b)}{c}$

C. $x = \frac{\log_{10}(a)}{c\log_{10}(b)}$

D. $x = \frac{\log_{10}(b)-\log_{10}(a)}{c}$

E. $x = \frac{\log_{10}(b)+\log_{10}(a)}{c}$

Question 35

Find the value of x in the following equation:

$$\left(1-\frac{1}{2^2}\right)\left(1-\frac{1}{3^2}\right)\left(1-\frac{1}{4^2}\right)\ldots\left(1-\frac{1}{2011^2}\right)=\frac{x}{2\cdot 2012}$$

A. 2010

B. 2013

C. 2011

D. 2012

E. None of the previous choices

Question 36

Three factories produce computers, totaling 370 units per month. Factory A produces one third as much as Factory B, and Factory B produces 20 less units per month than Factory C. What is the monthly output of Factory B?

A. 170 units

B. 50 units

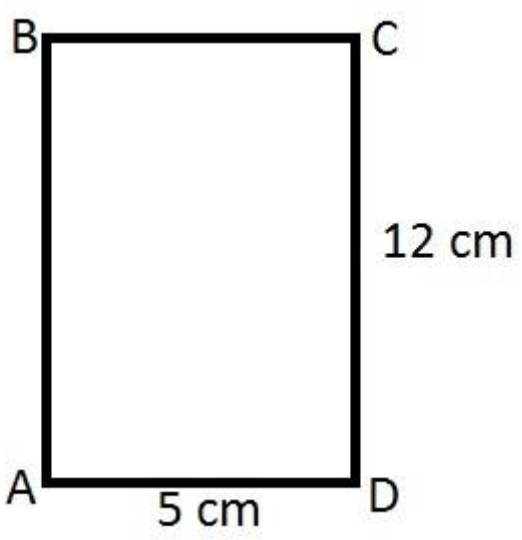
C. 70 units

D. 150 units

E. 120 units

Question 37

Suppose the rectangle in the figure is rotated about side AB. What is the surface area of the resulting cylinder?



A. 170π cm^2

B. 408π cm^2

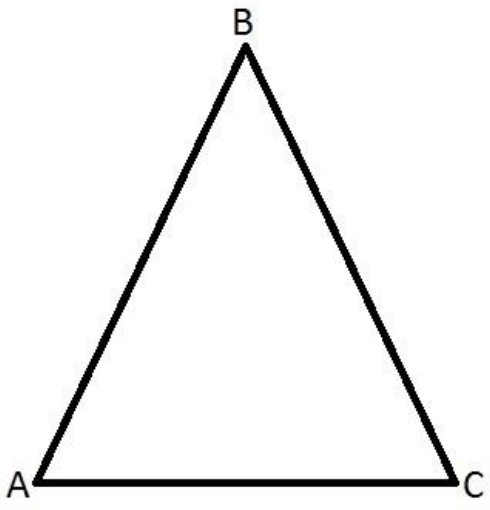
C. 120π cm^2

D. 145π cm^2

E. 150π cm^2

Question 38

In the figure, sides AB and BC of the triangle are both of length $\frac{\sqrt{(2)}}{2}$, and angle C is 15 degrees. What is the measure of side AC?



A. $\frac{1}{(1-\sqrt{(5)})}$

B. $\frac{2}{(1-\sqrt{(3)})}$

C. $\sqrt{(\frac{(2+\sqrt{(3)})}{2})}$

D. $\frac{1}{(\sqrt{(3)}-1)}$

E. $\frac{1}{(\sqrt{(3)}+1)}$

Question 39

Let $f(x) = x^3 + 5x^2 + \frac{17x}{4} + 1$, and let a, b, and c be the roots of $f(x) = 0$. What is the value of $a^2+b^2+c^2$?

A. 25

B. 9

C. 17

D. $\frac{33}{2}$

E. 15

Question 40

If x and y are positive real numbers, neither of which is equal to 1, what is the smallest non-negative value of $\log_x(y) + \log_y(x)$?

A. 0

B. $\sqrt{2}$

C. $\sqrt{\pi}$

D. 2

E. 10