

1

A dollar-store outlet wants to hire students for the summer. The manager can hire at most 20 students. He wants to employ at least three times as many female students as male students.

Let x : number of female students
 y : number of male students

Which of the following systems of constraints could describe this situation?

A) $x \geq 0$
 $y \geq 0$
 $x + y \geq 20$
 $x \geq 3y$

C) $x \geq 0$
 $y \geq 0$
 $x + y \leq 20$
 $x \geq 3y$

B) $x \geq 0$
 $y \geq 0$
 $x + y \geq 20$
 $y \geq 3x$

D) $x \geq 0$
 $y \geq 0$
 $x + y \leq 20$
 $y \geq 3x$

2

Consider an exponential function of the form $f(x) = ac^{b(x-h)} + k$ where $c > 1$.

If $a > 0, b < 0, h < 0, k > 0$

Which of the following is TRUE?

- A) f is decreasing and has no zero.
- B) f is increasing and has no zero.
- C) f is decreasing and has one zero.
- D) f is increasing and has one zero.

3 Given : $\log_c 3 = x$ and $\log_c 2 = y$,

Which of the following is equivalent to $\log_c 72c^4$?

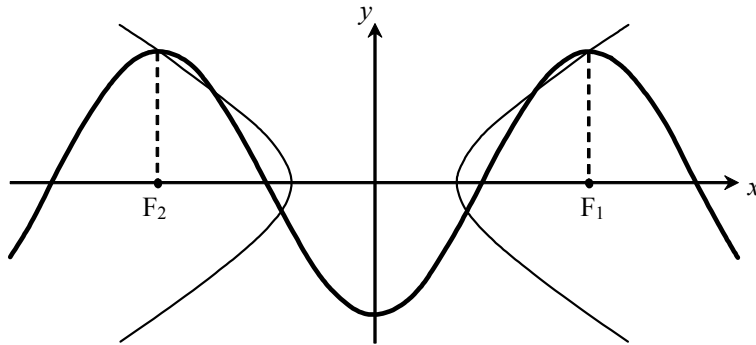
- A) $x^2 + y^3 + 4$ C) $8x + 12y + 4$
B) $2x + 3y + 4$ D) $4x^2 + 4y^3 + 4$

4 Consider a parabola with vertex $(-1, 4)$ and focus $(-4, 4)$.

Which of the following is the equation of the parabola in standard form?

- A) $(y - 4)^2 = 12(x + 1)$ C) $(y - 4)^2 = -12(x + 1)$
B) $(x + 1)^2 = 12(y - 4)$ D) $(x + 1)^2 = -12(y - 4)$

5 A hyperbola and a trigonometric function are drawn on the same Cartesian plane. The equation of the hyperbola is $\frac{x^2}{25} - \frac{y^2}{144} = 1$.



The foci of the hyperbola are directly below two of the maxima of the trigonometric function.

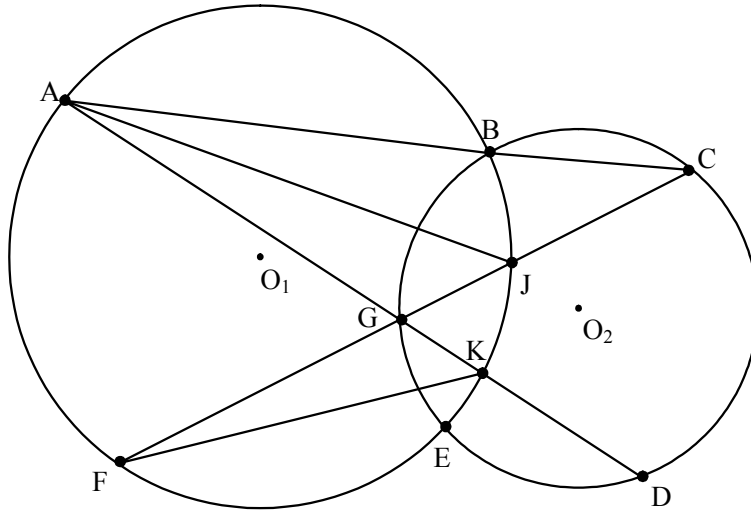
Which of the following is an equation of the trigonometric function?

(Where necessary, the numbers have been rounded.)

- A) $y = 28.8 \cos\left(\frac{\pi}{13}(x + 13)\right)$ C) $y = 23.3 \cos\left(\frac{\pi}{11}(x + 11)\right)$
B) $y = 28.8 \cos\left(\frac{2\pi}{13}(x + 13)\right)$ D) $y = 23.3 \cos\left(\frac{2\pi}{11}(x + 11)\right)$

6

In the diagram below, the circles with centres O_1 and O_2 intersect at points B and E. Line segment \overline{AC} passes through point B.

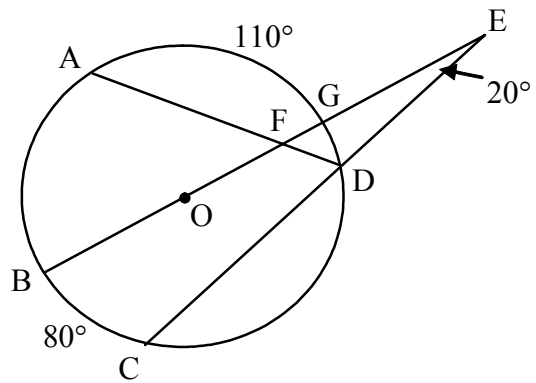


Which of the following statements is TRUE?

- A) $m \angle JGK = 2(m \angle JFK)$
- B) $(m \overline{FG})(m \overline{GC}) = (m \overline{AG})(m \overline{GD})$
- C) $m \angle BAJ = m \angle BCJ$
- D) $(m \overline{CB})(m \overline{CA}) = (m \overline{CJ})(m \overline{CF})$

7

In the adjacent circle with centre O,
 $m \widehat{AG} = 110^\circ$
 $m \widehat{BC} = 80^\circ$
 $m \angle BEC = 20^\circ$

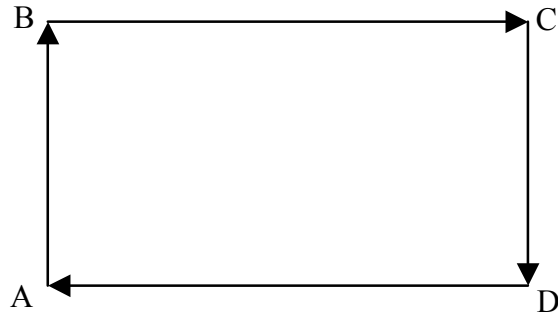


What is the measure of $\angle AFB$?

- A) 35°
- B) 40°
- C) 55°
- D) 70°

8

Given vectors \overrightarrow{AB} , \overrightarrow{BC} , \overrightarrow{CD} , \overrightarrow{DA} below:



Which proposition is TRUE?

A) $\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CD} = \overrightarrow{DA}$

C) $\overrightarrow{AB} + \overrightarrow{BC} = -(\overrightarrow{DA} + \overrightarrow{AB})$

B) $\overrightarrow{AB} + \overrightarrow{BC} = \overrightarrow{CD} + \overrightarrow{DA}$

D) $\overrightarrow{AB} + \overrightarrow{CD} = \vec{0}$

9

Which of the following is NOT affected by outliers in a data set?

A) Mean

C) Range

B) Mode

D) Standard deviation

10

Melanie and Robert are both taking Math 536 but are not in the same class. Melanie's class has a standard deviation of 6.7 and a mean of 72%. Robert's class has a mean of 75% with a standard deviation of 7. Melanie and Robert both have the same class mark. Melanie has a Z-score of 0.75.

What is Robert's Z-score?

A) -1.14

C) 0.71

B) 0.29

D) 0.75

Part B Questions 11 to 15

Write your answer in the space provided in the answer booklet.
Show your work, where required.

11

Consider the conic section whose equation is $\frac{(x-1)^2}{16} + \frac{(y+4)^2}{25} = 1$.

What are the coordinates of the foci?

12

A function is represented by the equation $f(x) = \frac{x+8}{x-2}$.

What equation can be used to represent $f^{-1}(x)$?

13

Given: $f(x) = \frac{x+2}{x+3}$ and $g(x) = 2x+5$.

What are the equations of the vertical and horizontal asymptotes of $(f \circ g)(x)$?

14

Consider the equation $2 \cos^2 \theta - 3 \sin \theta = 3$

What are the solutions, in radian measure, to the equation for which $0 \leq \theta \leq 2\pi$?

Show all your work.

15

Given: $\vec{u} = (-1, 1)$ and $\vec{v} = (1, 2)$.

What are the components of $\vec{u}(2\vec{u} \cdot 3\vec{v})$?

Show all your work.

Part C Questions 16 to 25

- ▶ Show all your **work** as well as your **answer**. The work shown is taken into consideration when marks are awarded.
- ▶ Your written information must be legible, complete, and clearly stated in correct language so the marker understands exactly what you have done.

Even if your answer is correct, no marks will be given unless acceptable work is shown.

16 The Grad Committee plans to sell chocolate bars to raise money for its upcoming dance. This year the committee members have decided to sell two types, one with roasted almonds and the other with caramel. They have a maximum of 500 bars to sell. They expect to sell a minimum of 120 almond chocolate bars. From past experience, almond chocolate bars sell at most 4 times as well as caramel ones. They make a profit of \$0.80 for each almond chocolate bar and \$1 for each caramel chocolate bar.

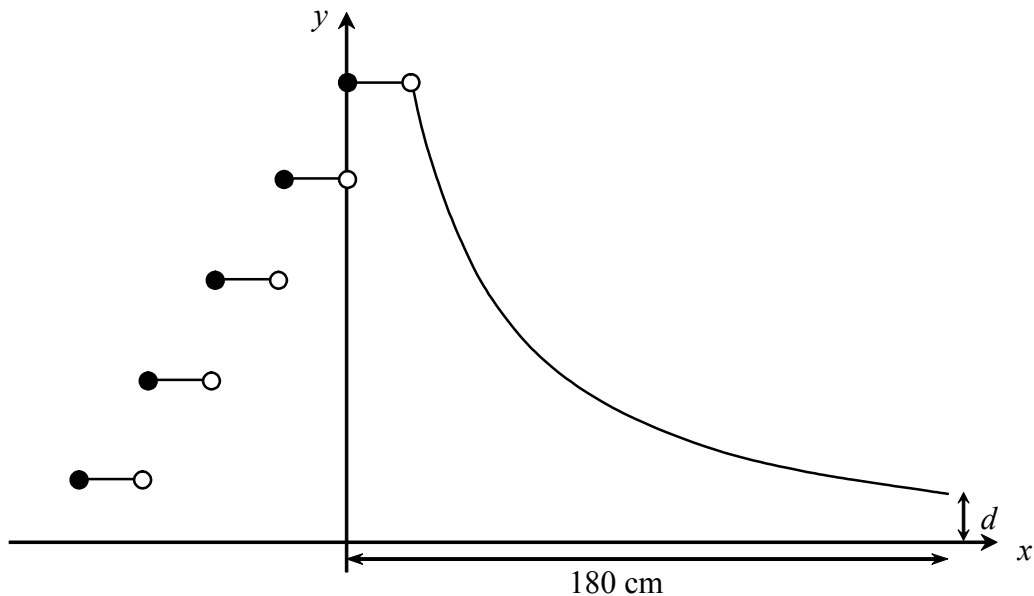
Let x : number of almond chocolate bars
 y : number of caramel chocolate bars

What is the difference in the maximum profit if they had expected to sell a minimum of 160 almond chocolate bars rather than 120?

Show all your work.

17

A designer is preparing a model of a children's slide. She began by drawing the steps and the slide on a Cartesian plane scaled in cm, as shown in the diagram below.



The steps of the slide are represented by the relation $y = 32.5[0.05x + 3] + 52.5$.
The top step begins on the y -axis. The slide is attached to the other end of the top step.

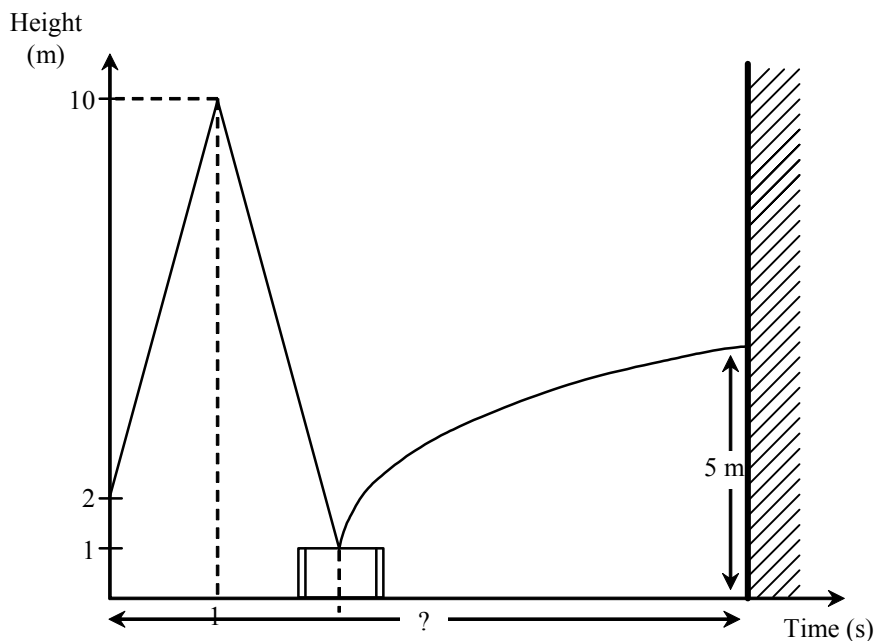
The slide is represented by a rational function with the equation $y = \frac{a}{x + 10} - 10$.

The end of the slide is 180 cm from the origin of the Cartesian plane.

To the nearest tenth of a centimetre, what is the distance (d) from the ground to the end of the slide?

18

A tennis ball is hit by a racket from a height of 2 metres and follows the path of an absolute value function. One second later the ball hits the ceiling, which has a height of 10 metres. On its way down, the ball bounces off a table that is 1 metre high. After the bounce, its path is a semi parabola. One second after the ball hits the table, it reaches a height of 3 metres before hitting a wall at a height of 5 metres.



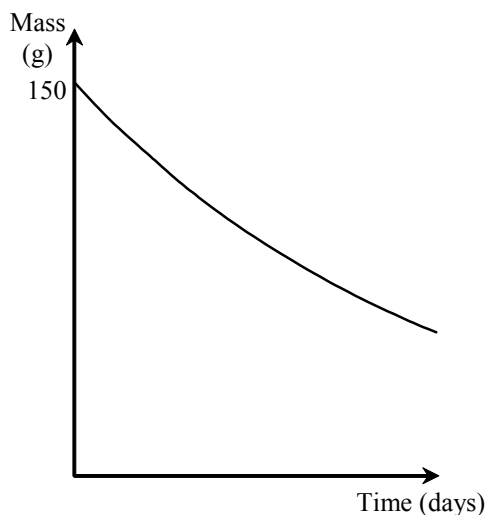
How many seconds after the ball was hit by the racket did it hit the wall?

19

A chemist is working with a dangerous compound she has just created. She began with 150 g of the compound, but noticed that it decays exponentially. After observing for 10 days, 123 g remained. She needs to know how long it will take until only half of the compound will be left.

Rounded to the nearest day, how many days after the experiment started will only half of the compound remains?

Show all your work.



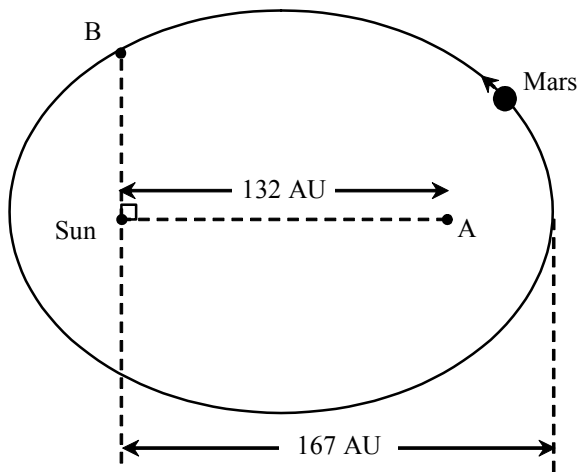
20

Mars' orbit around the Sun follows the path of an ellipse, as shown in the diagram on the right.

The foci for this path are the Sun and point A.

The distance between the Sun and point A, measured in astronomical units, is 132 AU.

The longest distance between the Sun and Mars is 167 AU.

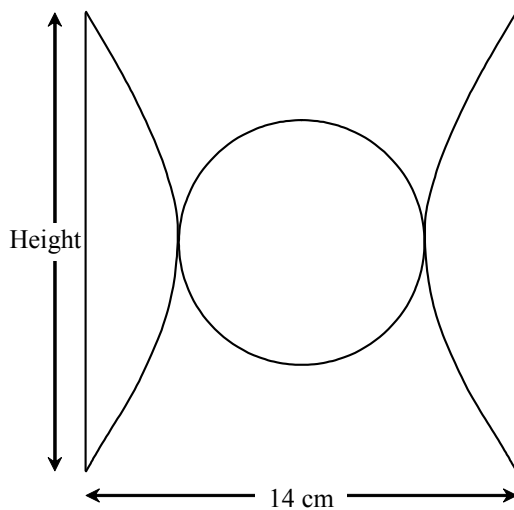


When Mars reaches point B on the graph, what is the distance from Mars to the Sun in AUs?

Round your answer to the nearest tenth.

21

A modern picture frame is in the shape of a circle between the two branches of a hyperbola, as shown in the diagram below.



The equation of the circle is $(x - 13)^2 + (y - 10)^2 = 16$. The centre of the circle and the centre of the hyperbola coincide. The vertices of the hyperbola are the endpoints of the horizontal diameter of the circle and the vertical edges of the picture frame pass through the foci of the hyperbola. The total length of the frame is 14 cm.

What is the height of the frame?

22

Canadian statistics show that the number of homicides in Canada were on the rise between 1980 and 1992.

Year	Number of Homicides
1980	592
1981	648
1982	667
1983	682
1984	667
1985	704
1986	569
1987	644
1988	576
1989	657
1990	660
1991	754
1992	732

More recent statistics show that 582 homicides occurred in 2002.

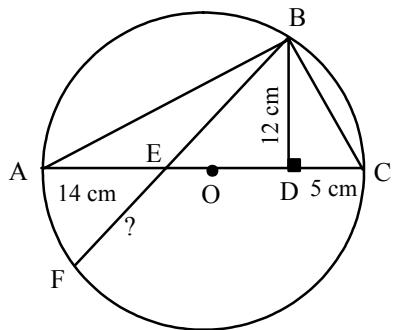
Is this consistent with the data given in the table?
Justify your answer using appropriate statistical analysis.

23

Consider the given circle, with centre O,

\overline{AC} is a diameter
 $\overline{BD} \perp \overline{AC}$

$m \overline{BD} = 12 \text{ cm}$
 $m \overline{DC} = 5 \text{ cm}$
 $m \overline{AE} = 14 \text{ cm}$

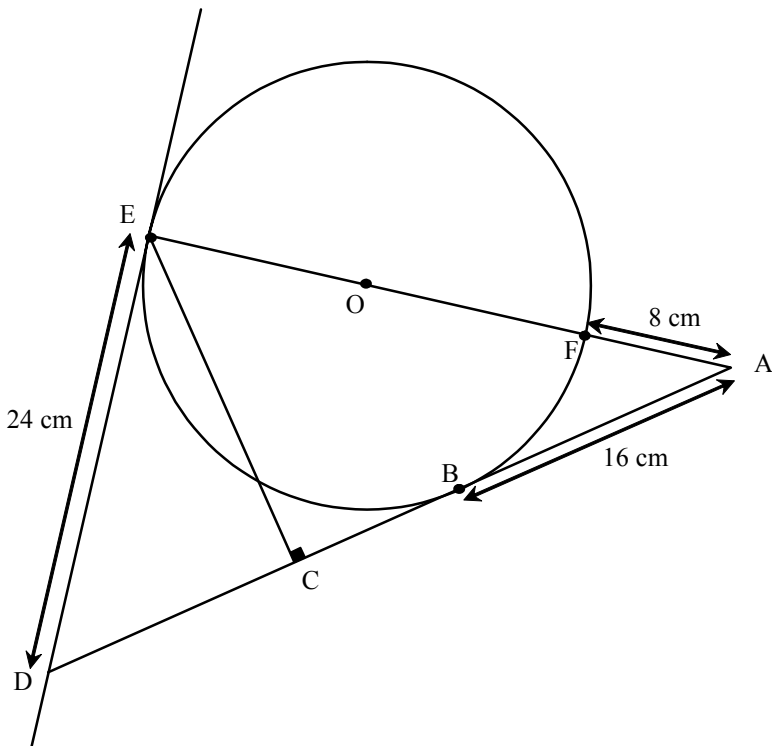


What is the measure of \overline{EF} ?
Round your answer to the nearest tenth.

24

In the diagram on the right:

- Segment \overline{AE} passes through the centre O of the circle, and intersects the circle at point F .
- The line containing segment \overline{DE} is tangent to circle O at point E .
- Segment \overline{AD} is tangent to circle O at point B .
- Segment \overline{EC} is perpendicular to segment \overline{AD} .
- $m \overline{DE} = 24 \text{ cm}$
- $m \overline{AF} = 8 \text{ cm}$
- $m \overline{AB} = 16 \text{ cm}$



What is the measure of \overline{EC} ?

25

A cuckoo clock uses a pendulum to keep time. The movement of the pendulum can be described by a sinusoidal function.

The length of the pendulum is 31 cm. At its lowest point, the pendulum is 1.5 m from the ground.

The pendulum starts its movement at t_1 . The interior angle between t_2 and t_3 is 90° and it takes the pendulum 0.875 second to go from t_2 to t_3 .

What is the height of the pendulum relative to the ground after 1 hour? Round your answer to the nearest centimetre.

