

Key

NC MATH 3 - RELEASED ITEMS



1 Let $f(x) = 14x^3 + 28x^2 - 46x$ and $g(x) = 2x + 7$. Which is the solution set to the equation $\frac{1}{12}f(x) = g(x)$?

- A $\{-3, 0, 1\}$
- B $\{-3, -1, 2\}$**
- C $\{-2, 1, 3\}$
- D $\{1, 5, 11\}$

$\frac{1}{12}(14x^3 + 28x^2 - 46x) = 2x + 7$
 $14x^3 + 28x^2 - 46x = 24x + 84$
 $14x^3 + 28x^2 - 70x - 84 = 0$
 Graph in calc

Table: $(-3, 0)$
 $(-1, 0)$
 $(2, 0)$

2 A function is shown below.

$$f(x) = \begin{cases} -x^2 + 2x & \text{for } x \leq -3 \\ 2\left(\frac{1}{3}\right)^{2x} & \text{for } -3 < x < 4 \\ \frac{2x - 5}{x - 7} & \text{for } x \geq 4 \end{cases}$$

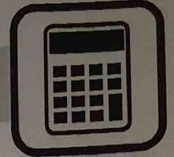
What is the value of the expression $f(-3) + 2f(-1) - f(4)$?

- A $\frac{101}{36}$
- B $\frac{32}{9}$
- C 4
- D 22**

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bottom eqn middle eqn top eqn

$-(-3)^2 + 2(-3) + 2\left(2\left(\frac{1}{3}\right)^{2(-1)}\right) - \left(\frac{2(4) - 5}{4 - 7}\right)$
 $-9 - 6 + 2(2(9)) - \left(\frac{3}{-3}\right)$
 $-15 + 2(18) - (-1)$
 $-15 + 36 + 1$
 22



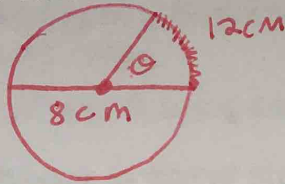
- 3 The diameter of a circle is 8 centimeters. A central angle of the circle intercepts an arc of 12 centimeters. What is the radian measure of the angle?

A $\frac{3}{2}$

B 3

C 4

D 8π



Arc length = $\frac{\theta}{360} \cdot 2\pi r$
 since this wants our answer in radians we'll slightly change the formula

$$12 = \frac{\theta}{2\pi} \cdot 2\pi(4)$$

$$12 = 4\theta$$

$$\theta = 3$$

- 4 To completely cover a spherical ball, a ball company uses a total area of 36 square inches of material. What is the maximum volume the ball can have?

(Note: Surface area of a sphere = $4\pi r^2$. Volume of a sphere = $\frac{4}{3}\pi r^3$.)

A 27π cubic inches

B $36\sqrt{\pi}$ cubic inches

C $\frac{36}{\sqrt{\pi}}$ cubic inches

D $\frac{27}{\pi}$ cubic inches

$$36 = 4\pi r^2$$

$$9 = \pi r^2$$

$$\frac{9}{\pi} = r^2$$

$$\sqrt{\frac{9}{\pi}} = r$$

$$\frac{3}{\sqrt{\pi}} = r$$

$$V = \frac{4}{3}\pi \left(\frac{3}{\sqrt{\pi}}\right)^3$$

$$V = \frac{4}{3}\pi \cdot \frac{3}{\sqrt{\pi}} \cdot \frac{3}{\sqrt{\pi}} \cdot \frac{3}{\sqrt{\pi}}$$

$$V = \frac{108\pi}{3\pi\sqrt{\pi}}$$

$$V = \frac{36}{\sqrt{\pi}}$$



- 5 A farmer wants to buy between 90 and 100 acres of land.
- He is interested in a rectangular piece of land that is 1,500 yards long and 300 yards wide.
 - The piece of land is being sold as one complete unit for \$87,000.

If the farmer does not want to spend more than \$900 an acre, does the land meet all of his requirements? (1 acre \approx 43,560 ft²)

- A Yes, the amount of land satisfies his needs, and the price is low enough.
 B No, the price is low enough, but there is too much land.
 C No, the price is low enough, but there is not enough land.
 D No, the amount of land satisfies what he needs, but the price is too high.

92.975 acres \$935.74/acre

- 6 A reporter wants to know the percentage of voters in the state who support building a new highway. What is the reporter's population?

- A the number of people who live in the state
 B the people who were interviewed in the state
 C all voters over 25 years old in the state
 D all eligible voters in the state

Two ways to do this one!!!
 (A) convert to feet before finding
 (B) find area then convert to feet

*the area:
 1500 yards \rightarrow 4500 feet
 300 yards \rightarrow 900 feet*

*Area of land: 4500×900
 4,050,000 ft²*

\div by acres: $\frac{4,050,000}{43,560}$

92.975 acres

find price per acre: $\frac{\$87,000}{92.975}$

*1500 x 300 = 450,000 yd²
 to convert this to feet
 we must multiply by 9
 b/c it's yards squared*

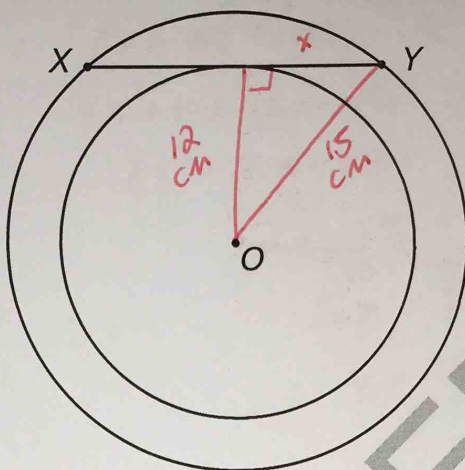
450,000 x 9 = 4,050,000

now repeat steps

\$935.73 per acre



7 The figure below shows concentric circles, both centered at O.



$$x^2 + 12^2 = 15^2$$

$$x^2 + 144 = 225$$

$$x^2 = 81$$

$$x = 9$$

$$\overline{XY} = 2(9)$$

- Chord XY is tangent to the smaller circle.
- The radius of the larger circle is 15 cm.
- The radius of the smaller circle is 12 cm.

What is the length of chord XY?

- A 27 cm
- B 24 cm
- C 18 cm
- D 10 cm

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8 What is the **approximate** length of the arc subtended by an angle of $\frac{4\pi}{3}$ radians on a circle with a radius of 6.00 meters?

- A 12.57 meters
- B 14.14 meters
- C 25.13 meters
- D 28.27 meters

**could also change $\frac{4\pi}{3}$ to 240° & use our usual formula:*

$$\text{Arc Length} = \frac{240}{360} \cdot 2\pi(6)$$

ARC LENGTH:

$$\frac{\theta}{360} \cdot 2\pi r$$

or

$$\frac{\theta}{2\pi} \cdot 2\pi r$$

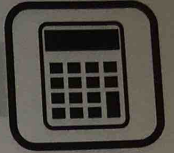
$$\text{Arc Length} = \frac{4\pi/3}{2\pi} \cdot 2\pi(6)$$

$$\text{Arc Length} = \frac{4\pi}{3} \cdot 6$$

Go to the next page.

$$\text{Arc Length} = \frac{24\pi}{3}$$

$$\text{Arc Length} = 8\pi$$



9 What is the solution to the equation $\frac{2x - 3}{x - 1} = \frac{8x + 1}{4x + 5}$?

A $-\frac{14}{5}$

B $-\frac{14}{9}$

C $\frac{14}{9}$

D $\frac{14}{5}$

$(2x-3)(4x+5) = (x-1)(8x+1)$
 $8x^2 + 10x - 12x - 15 = 8x^2 + x - 8x - 1$
 $8x^2 - 2x - 15 = 8x^2 - 7x - 1$
 $-2x - 15 = -7x - 1$
 $5x = 14$
 $x = 14/5$

10 Which expression is equivalent to $\frac{x + 7}{x^2 + 4x - 21} \div \frac{x + 5}{x^2 + 8x + 15}$ when x is restricted so that the expressions are defined?

A $\frac{x + 3}{x - 3}$

B $\frac{x - 3}{x + 3}$

C 1

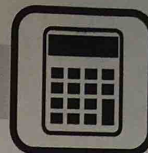
D -1

keep, change, flip

$\frac{x+7}{x^2+4x-21} \cdot \frac{x^2+8x+15}{x+5}$

$\frac{\cancel{x+7}}{(x+7)(x-3)} \cdot \frac{(x+5)(x+3)}{\cancel{(x+5)}}$

$\frac{x+3}{x-3}$



11 Which function has a point of discontinuity at $x = 3$ when graphed?

A $f(x) = \begin{cases} 3x + 1 & \text{for } x < 3 \\ x^2 + 1 & \text{for } x \geq 3 \end{cases}$

B $f(x) = |x - 3| + 2$

C $f(x) = \frac{x - 3}{x^2}$

D $f(x) = \frac{x + 2}{x^2 - 9}$
 $\frac{x + 2}{(x - 3)(x + 3)}$
 ↑ ↑ create vertical asymptotes at $x = 3$ & $x = -3$

12 Joshua is constructing a triangle with a circle inscribed in it. Each vertex of the triangle will have a line passing through it bisecting the angle. No matter where he places the third vertex, the following conditions will be true:

- Each line will always bisect its corresponding vertex angle.
- The three lines will always intersect at the center of the circle.
- The circle will always be inscribed in the triangle.

Which type of center exists where the three lines intersect?

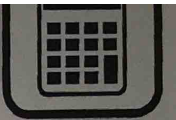
A centroid

B circumcenter

C midpoint

D incenter

incenter — angle bisectors!



13 The function $y = a(1.20)^t$ models the value of an investment after t years. Based on the function, what is the **approximate** monthly interest rate?

A 8.9%

B 8.3%

C 1.5%

D 1.0%

$$1.20 = 1 + r$$

$$.20 = r$$

* Monthly $\rightarrow \div$ by 12

$$\frac{.20}{12}$$

$$= .01667$$

approximate monthly interest rate

this is yearly interest rate

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