Released Items

Student Name: _Key_

NC Math 3

3

2017–2018

NC Final Exam

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

Handwritten: $12\left(\frac{1}{12}\right)(14x^3 + 28x^2 - 46) = (2x + 7)12$

A   {⁻3, 0, 1}

B   {⁻3, ⁻1, 2}

C   {⁻2, 1, 3}

D   {1, 5, 11}

Handwritten work:
$14x^3 + 28x^2 - 46x = 24x + 84$
$-24x \qquad -24x - 84$
-84
$14x^3 + 28x^2 - 70x - 84 = 0$
(Use Calc.)

Calc Step:
$y = $ | in Y_1 | 2nd graph | zeros in the y - column

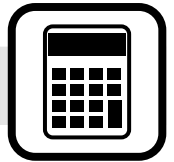2 A function is shown below.

Handwritten: Piecewise Function

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

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

Handwritten work:
$-(-3)^2 + 2(-3)$ $2\left(\frac{1}{3}\right)^{2(-1)}$ $\dfrac{2(4) - 5}{4 - 7}$
$-9 - 6$ $2(18)$ $\dfrac{3}{-3} = -1$
-15 36

$-15 + 36 - (-1)$
$21 + 1$
22

A $\dfrac{101}{36}$

B $\dfrac{32}{9}$

C   4

D   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?

Handwritten: $r = 4$ $\theta = ?$

Handwritten: $S = 12 /$ arc length

A $\frac{3}{2}$

B   3

C   4

D 8π

Handwritten:
Arc Length:
$S = r\theta$
$\frac{12}{4} = \frac{4\theta}{4}$ (always in radians)
$\theta = 3$ radians

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?

Handwritten: $SA = 36\ in^2$

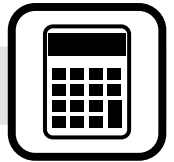(Note: Surface area of a sphere = $4\pi r^2$. Volume of a sphere = $\frac{4}{3}\pi r^3$.)

A 27π cubic inches

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

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

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

Handwritten:
$SA = 4\pi r^2$ $V = \frac{4}{3}\pi r^3$
$\frac{36}{4\pi} = \frac{4\pi r^2}{4\pi}$ $V = \left(\frac{4\pi}{3}\right)\left(\frac{3}{\sqrt{\pi}}\right)^3$ $(\sqrt{\pi} \cdot \sqrt{\pi}) \cdot \sqrt{\pi}$
$\sqrt{\frac{9}{\pi}} \text{ \& } \sqrt{\frac{9}{\pi}} = \sqrt{r^2}$ $\pi\sqrt{\pi}$
$V = \left(\frac{4\pi}{3}\right)\left(\frac{27}{\pi\sqrt{\pi}}\right)$
$\frac{3}{\sqrt{\pi}} = r$ $V = \frac{36}{\sqrt{\pi}}$

5   A farmer wants to buy between 90 and 100 acres of land. *(handwritten: 1 yd = 3 ft)*

(handwritten: A = l·w)

- He is interested in a rectangular piece of land that is 1,500 yards long and 300 yards wide. *(handwritten: 1500 · 300 = 450,000 yds² × 3 = 1,350,000 ft²)*
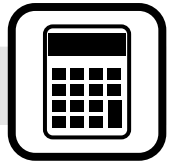- The piece of land is being sold as one complete unit for $87,000.

If the farmer does not want to spend more than $900 an acre, does the land meet all of his requirements? (1 acre ≈ 43,560 ft²) *(handwritten: 1,350,000 / 43,560 ≈ 31 acres ×900 = $27,900)*
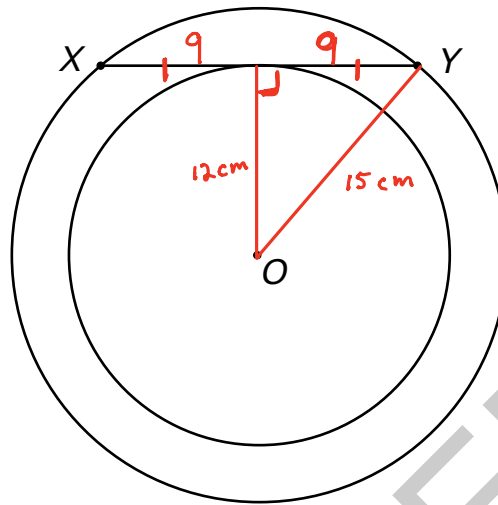
A   Yes, the amount of land satisfies his needs, and the price is low enough.

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.

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

Go to the next page.

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

Handwritten annotations: Share the same center

Handwritten annotations on figure: 9, 9, 12cm, 15 cm

Handwritten work:
$$a^2 + b^2 = c^2$$
$$x^2 + 12^2 = 15^2$$
$$-12^2 \quad -12$$
$$\sqrt{x^2} = \sqrt{81}$$
$$x = 9$$
(half a chord XY)
$$9 \cdot 2 = 18 \text{ cm}$$

- 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

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?
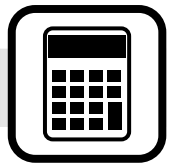
Handwritten annotations: $S = r\theta$, θ, $r = 6$

A   12.57 meters

B   14.14 meters

(C)   25.13 meters

D   28.27 meters

Handwritten work:
$$S = r\theta$$
$$S = 6\left(\frac{4\pi}{3}\right)$$
$$S = 25.13 \text{ cm}$$

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

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

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

C $\dfrac{14}{9}$

D $\dfrac{14}{5}$

(handwritten work)

$(2x-3)(4x+5) = (8x+1)(x-1)$

$8x^2 - 2x - 15 = 8x^2 - 7x - 1$

$-2x - 15 = -7x - 1$

$5x - 18 = -1$

$5x = 14$

$x = \dfrac{14}{5}$

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

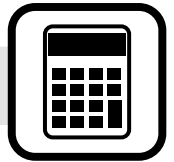A $\dfrac{x+3}{x-3}$

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

C 1

D $^-1$

(handwritten work)

Factor completely

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

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

$\dfrac{(x+3)}{(x-3)}$

Zero occurs on the bottom ← *Vertical Asymptotes or Holes →* *occurs when exp. cross out*

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

↳ plug in 3 for x

↳ see what function gives a zero on the bottom.

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 $f(x) = \dfrac{x - 3}{x^2} = \dfrac{3-3}{(3)^2} = \dfrac{0}{9}$

D $f(x) = \dfrac{x + 2}{x^2 - 9}$

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

Go to the next page.

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?

12

A   8.9%

B   8.3%

C   1.5%

D   1.0%

$1.20 - 1 = .20 \times 100 = \dfrac{20\%}{12}$ (for the year)

$\approx 1.\overline{6}\%$ (for each month)

RELEASED

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