Name: Cron Period: _____ Date: _____

2021 IM3 Item Release Questions

1.

Which rational expression is equivalent to $\frac{x^2+2x-15}{x^2-25}$?

$\frac{(x+5)(x-3)}{(x+5)(x-5)} = \frac{x-3}{x-5}$ Factor & cancel!

A. $\frac{x-3}{x-5}$

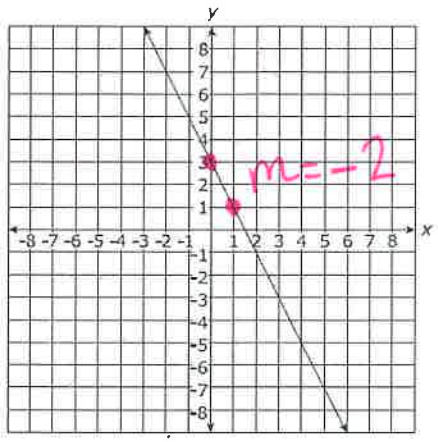
B. $\frac{x+3}{x+5}$

C. $\frac{2x-15}{-25}$

D. $\frac{2x}{x-10}$

2.

A line is graphed on the coordinate plane.



What is the equation of the line perpendicular to this line that passes through the point $(-2,7)$?

$m = 1/2$

$y = mx + b$

$7 = \frac{1}{2}(-2) + b$

$7 = -1 + b$

$+1 \quad +1$

$b = 8$

$y = \frac{1}{2}x + 8$

A. $y = -2x + 3$

B. $y = \frac{1}{2}x + 6$

C. $y = \frac{1}{2}x + 8$

D. $y = 2x + 11$

Just slopes give correct answer, but you can work it all out.

3.

A sample of 10,000 bacteria decreases in number by 25% per week.

How many bacteria will there be in 4 weeks?

exponential decay – b-term is < 1

$B(t) = 10{,}000(1-0.25)^t$

$= 10{,}000(0.75)^t$

$B(4) = 10{,}000(0.75)^4$

$= 3164.06$

A. 7,500

B. 3,164

C. 39

D. 0

4.

The amount of medication M (in milligrams) needed by a patient over a period of h hours can be estimated by $M = 2.4(2.7)^{-0.4h}$.

Which expression is approximately equal to M?

See $-0.4h$ as $-0.4 \cdot h$, so

$2.4(2.7^{-0.4})^h$ Power-to-a-power

$2.4(0.67)^h$

A. $(1.6)^h$

B. $(1.6)^{-h}$

C. $2.4(0.67)^h$

D. $2.4(0.67)^{-h}$

Remember, a chord is a line segment in a circle. The longest chord is a diameter & a chord can be any length less than that.

5.

Circle P contains chord $\overline{AB}$. The area of the circle is 100π square inches.

Which measure could be the length of $\overline{AB}$?

Select the **three** that apply.

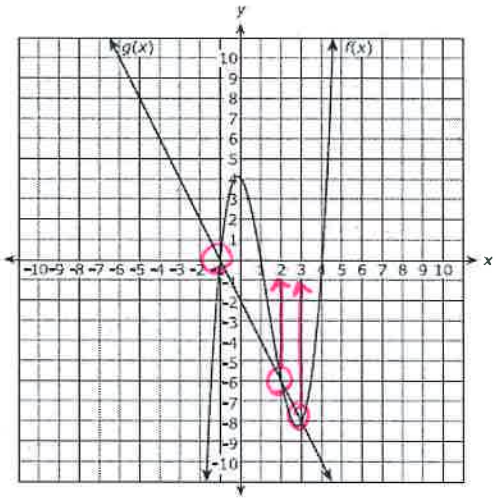
A. 10 in.
B. 19 in.
C. 20 in.
D. 50 in.
E. 100 in.

$A = \pi r^2$
$\pi r^2 = 100\pi$
$r = 10$
so diameter = 20

A chord can be 20" or anything less.

6.

The graphs of $f(x)$ and $g(x)$ are shown.



For what values of x is $f(x) = g(x)$?

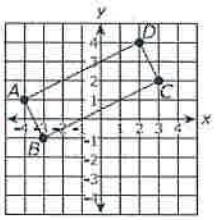
Select **all** that apply.

A. −8
B. −6
C. −1
D. 0
E. 2
F. 3

x-values of intersections!

7.

Given: Quadrilateral $ABCD$ is plotted on the coordinate plane with $A(-4, 1)$, $B(-3, -1)$, $C(3, 2)$, and $D(2, 4)$ as shown in the figure.



Rectangle:
1.) adjacent sides = perpend. (90° angles)
2.) 2 pair parallel sides

Which **two** of the following facts, when used together, are sufficient to prove that quadrilateral $ABCD$ is a rectangle?

A. The length of $\overline{BC}$ is greater than the length of $\overline{DC}$.
B. The slope of $\overline{AB}$ is the opposite reciprocal of the slope of $\overline{BC}$.
C. Diagonals $\overline{AC}$ and $\overline{BD}$ intersect in the interior of the quadrilateral.
D. The slope of $\overline{AB}$ is equal to the slope of $\overline{CD}$, and the slope of $\overline{AD}$ is equal to the slope of $\overline{BC}$.
E. The length of $\overline{AB}$ is less than the length of $\overline{BC}$, and the length of $\overline{CD}$ is less than the length of $\overline{AD}$.

8.

To get center, change signs → $(-\frac{3}{2}, -\frac{2}{3})$

Circle Q is represented by the given equation.

$$\left(x+\frac{3}{2}\right)^2+\left(y+\frac{2}{3}\right)^2=2$$

$(x-h)^2 + (x-k)^2 = r^2$

$r^2 = 2$
$r = \sqrt{2}$

What are the coordinates of the center and the length of the diameter, d, of circle Q?

A. $Q\left(\frac{3}{2}, \frac{2}{3}\right)$ and $d = \sqrt{2}$ units
B. $Q\left(\frac{3}{2}, \frac{2}{3}\right)$ and $d = 2\sqrt{2}$ units
C. $Q\left(-\frac{3}{2}, -\frac{2}{3}\right)$ and $d = \sqrt{2}$ units
D. $Q\left(-\frac{3}{2}, -\frac{2}{3}\right)$ and $d = 2\sqrt{2}$ units

This is a trick; the formula gives r^2, so here, $r = \sqrt{2}$, then the diameter would $= 2\sqrt{2}$

Regression in calculator! STAT Button

9.

A school district collects its student enrollment data at the beginning of several school years. The data are organized in the table as shown.

Student Enrollment

Year	Enrollment
2010	21,840
2012	22,495
2014	23,170
2016	23,865

$y = 21{,}839.95(1.0149)^x$

Using an exponential model, in what year should the school district expect that the student enrollment at the beginning of the school year will be greater than 28,000 students for the first time?

A. 2026

B. 2027

C. 2028

D. 2029

Put equation in for y_1, go to table (2nd Graph), find first y-value > 28,000. It is at x = 17. 2010 + 17 = 2027

10.

The binomial $(x - d)$ is a factor of $p(x) = ax^2 - bx + 10$. What equation must be true?

A. $p(d) = 0$

B. $p(d) = 10$

C. $p(-d) = 0$

D. $p(-d) = 10$

$(x-d)$ is a factor, so when we plug in that zero #, (d), it will equal zero! $p(d) = 0$

11.

The method Wayne used to solve an equation is shown.

$\sqrt{3x+7} = (x+3)^2$

- Result of Step 1: $3x + 7 = x^2 + 9$
- Result of Step 2: $0 = x^2 - 3x + 2$
- Result of Step 3: $0 = (x - 2)(x - 1)$
- Result of Step 4: $x - 2 = 0$ or $x - 1 = 0$
- Result of Step 5: $x = 2$ or $x = 1$

$(x+3)^2 = (x+3)(x+3) = x^2+6x+9 \neq x^2+9$ wrong

Which statement evaluates Wayne's method for solving the equation?

A. Wayne's first mistake was made in Step 1.

B. Wayne's first mistake was made in Step 2.

C. Wayne's first mistake was made in Step 3.

D. Wayne did not make a mistake when solving the equation.

12.

What is the value of t in the equation $-3e^{2t} = 12$?

$\ln e^{2t} = \ln(-4)$

Impossible — arguments can't be negative

$e^? = -4$ No power can make a positive base negative

A. $\ln(-6)$

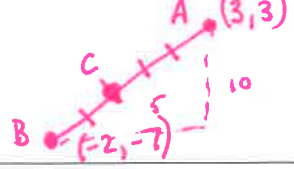
B. $\frac{1}{2}\ln(9)$

C. $\frac{1}{2}\ln(15)$

D. no real solution

13.

On a coordinate grid, Point A is located at (3, 3) and Point B is located at $(-2, -7)$. Point C is located on $\overline{AB}$ so that the ratio of AC to CB is 3:2. What are the coordinates of point C?



$x \to -2 + \frac{2}{5}(5) = 0$

$y \to -7 + \frac{2}{5}(10) = -3$

A. (0, −3)

B. $\left(\frac{1}{2}, -2\right)$

C. (−3, 0)

D. (−4, 3)

14.

Which statements describe the key features of the graph of the function $f(x) = \log_4 x$?

Select all that apply.

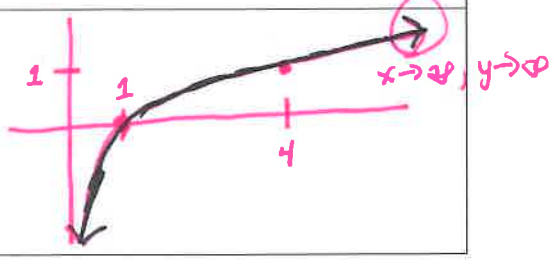
A. The y-intercept is 0. (no y-int.)

B. The x-intercept is 1.

C. As x approaches infinity, $f(x)$ approaches infinity.

D. The point (2, 16) is on the graph of $f(x)$. ($\log_4 2 \neq 16$)

E. The domain is $x > 0$.

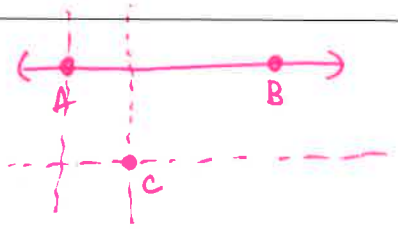


15.

Maria drew a line $\overleftrightarrow{AB}$ with point C not on $\overline{AB}$.

Which procedure(s) could Maria use to construct a line through point C that is parallel to $\overline{AB}$?

Select **all** that apply.



A. Construct line l through point C perpendicular to $\overline{AB}$, and then construct a line perpendicular to line l at point C. ✓

B. Construct line l through point C perpendicular to $\overline{AB}$, and then construct a line perpendicular to line l at point B. ? That would be line AB

C. Construct line l through point A perpendicular to $\overline{AB}$, and then construct a line perpendicular to line l at point C. ✓

D. Construct line l through point A and point C, and then construct a line perpendicular to line l at point C. Diagonal?

E. Construct line l through point B and point C, and then construct a line perpendicular to line l at point B. Diagonal?

16.

Which expression is equivalent to $3x^2 - 12x + 13$?

A. $3(x-2)^2+1$

B. $3(x-2)^2+7$

C. $3(x-2)^2+11$

D. $3(x-2)^2+25$

The $3(x-2)^2$ is the same for all choices

$= 3(x-2)(x-2)$

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

$= 3x^2-12x+12$

$12 + ? = 13$

1

17.

The elevation of a race, in meters above sea level, as a function of its distance in kilometers from the start line is described by the function $h(x) = -x^4 + 7x^3 - 4x^2 - 12x$.

On which of the intervals is the elevation of the race decreasing?

starts decr.

Max @ $x = -0.57$

Min @ $x = 1.13$

↳ stops decr.

A. $[0, 3]$

B. $[0, 1]$

C. $[1, 2]$

D. $[2, 3]$

Graph in calculator & determine where graph is "going down" from left to right (decreasing).

18.

Functions $f(x)$ and $g(x)$ are shown below.

$y_1 \rightarrow f(x) = |x+1|$

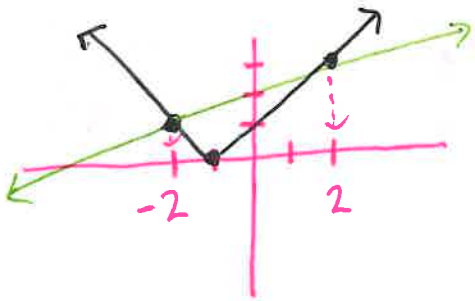
$y_2 \rightarrow g(x) = \frac{1}{2}x + 2$

Graph & find intersections!

absolute value → MATH → NUM → 1:abs(

What are the solutions of the equation $f(x) = g(x)$?

Select **all** that apply.



A. -2

B. -1

C. 1

D. 2

E. 3