Pay attention to the strong distractors in each multiple-choice question.

Don't consider these questions to be the only way the standards will be assessed.

Don't assume that the sample questions represent a mini-version of future State exams.

Understanding Math Sample Questions

Multiple-Choice Questions

1 What is the solution set of the equation $\dfrac{3x}{x} - \dfrac{25}{7} = 5 - \dfrac{3}{x}$?

(1) $\dfrac{3}{2}, 7$

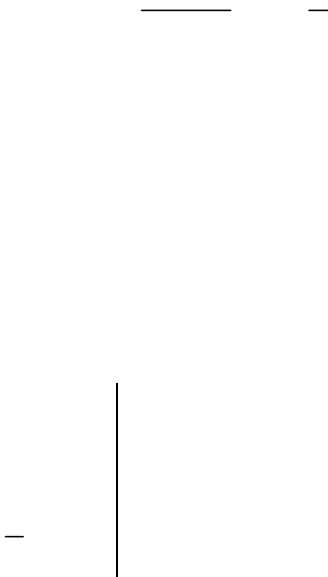(2) $\dfrac{7}{2},\ 3$

(3) $\dfrac{3}{2}, 7$

$\dfrac{7}{}$

Key: 4

Measures CCLS Cluster: A-REI.A

Mathematical Practice: 2, 7

Commentary: This question measures A-REI.A because

_____ _

_

2   Functions f, g, and h are given below.

$$f(x) = \sin(2x)$$
$$g(x) = f(x) + 1$$

_____

_____

_____

_____

_____

Measures CCLS Cluster: F-BF.B

Mathematical Practice: 2, 5

Commentary: This question measures F-BF.B because students must be able to recognize even and odd functions.

Rationale: Option 3 is correct.

$$f(-x) = -f(x) \text{ or } f \text{ is symmetric about the origin}$$
$$f(x) \quad \text{odd}$$

$$h(-x) = h(x) \text{ or } h \text{ is symmetric about the } y\text{-axis}$$
$$h(x) \quad \text{even}$$

For example, consider $x = 1$

$$g(1) = 1.9093$$
$$g(-1) = .0907$$
$$g(-x) \neq g(x) \quad \text{not even}$$
$$g(-x) \neq -g(x) \quad \text{not odd}$$
$$g(x) \quad \text{neither}$$

Key: 1

Measures CCLS Cluster: A-APR.D

Mathematical Practice: 8

Commentary: This question measures A-APR.D because students must rewrite a simple rational expression in quotient-remainder form.

Rationale: Option 1 is correct.

$$
\begin{array}{r}
3x^2 \quad 4x \quad 1 \\
2x \quad 3 \overline{)6x^3 \quad 17x^2 \quad 10x \quad 2} \\
\underline{6x^3 \quad 9x^2} \\
8x^2 \quad 10x \\
\underline{8x^2 \quad 12x} \\
2x \quad 2 \\
\underline{2x \quad 3} \\
5
\end{array}
$$

$$
3x^2 \quad 4x \quad 1 \quad \dfrac{5}{2x \quad 3}
$$

4 The solutions to the equation $\dfrac{1}{2}x^2 \;\; 6x \;\; 20$ are

(1) $\;6\;\;2i$

(2) $\;6\;\;2\sqrt{19}$

(3) $6\;\;2i$

(4) $6\;\;2\sqrt{19}$

Key: 3

Measures CCLS Cluster: A-REI.B

Mathematical Practice: 7

Commentary: This question measures A-REI.B because students must solve a quadratic equation with complex solutions.

Rationale: Option 3 is correct.

<div>

Method 1:

$$\frac{1}{2}x^2 \quad 6x \quad 20$$

$$\frac{1}{2}x^2 \quad 6x \quad 20 \quad 0$$

$$x \quad \frac{6 \quad \sqrt{36 \quad 4\left(\frac{1}{2}\right) \quad 20}}{2\left(\frac{1}{2}\right)}$$

$$x \quad \frac{6 \quad \sqrt{4}}{1}$$

$$x \quad 6 \quad 2i$$

Method 2:

$$2\left(\frac{1}{2}x^2 \quad 6x \quad 20\right)$$

$$x^2 \quad 12x \quad 40$$

$$x^2 \quad 12x \quad 40 \quad 0$$

$$x^2 \quad 12x \quad 36 \quad 40 \quad 36$$

$$(x \quad 6)^2 \quad 4$$

$$x \quad 6 \quad 2i$$

$$x \quad 6 \quad 2i$$

</div>

5 What is the completely factored form of k^4 $4k^2$ $8k^3$ $32k$ $12k^2$ 48?

(1) k 2 k 2 k 3 k 4

(2) k 2 k 2 k 6 k 2

(3) k 2 k 2 k 3 k 4

(4) k 2 k 2 k 6 k 2

Key: 4

Measures CCLS Cluster: A-SSE.A

Mathematical Practice: 5, 7

Commentary: This question measures A-SSE.A because students use the structure of an expression to identify ways to rewrite it.

Rationale: Option 4 is correct.

$$k^4 \quad 4k^2 \quad 8k^3 \quad 32k \quad 12k^2 \quad 48$$

$$k^4 \quad 4k^2 \quad 8k^3 \quad 32k \quad 12k^2 \quad 48$$

$$k^2 \quad k^2 \quad 4 \qquad {}^2 \qquad {}^2$$

6 Which statement is *incorrect* for the graph of the function $y = 3\cos\left(\frac{\pi}{3}x + 4\right) + 7$?

(1) The period is 6.

(2) The amplitude is 3.

(3) The range is [4,10].

(4) The midline is $y = 4$.

Key: 4

Measures CCLS Cluster: F.IF.C

Mathematical Practice: 5, 7

Commentary: This question measures F-IF.C because students must determine key features of the graph of a given trigonometric function.

Rationale: Option 4 states an incorrect midline.

The midline is $y = 7$ since 7 is the average of the endpoints of the range.

7 Algebraically determine the values of x that satisfy the system of equations below.

$$y = 2x - 1$$
$$y = 2x^2 - 3x - 1$$

Key: $0, \dfrac{5}{2}$

Measures CCLS Cluster: A-REI.C

Mathematical Practice: 2, 7

Commentary: This question measures A-REI.C because students must be able to solve a linear-quadratic system in two variables.

Rationale:

$$2x + 1 = 2x^2 + 3x + 1$$
$$2x^2 + 5x = 0$$
$$x(2x + 5) = 0$$

$$x = 0 \quad \Big| \quad 2x + 5 = 0$$
$$\qquad\qquad x = \dfrac{5}{2}$$

Rubric:

[2] $0, \dfrac{5}{2}$ and correct algebraic work is shown.

[1] Appropriate work is shown, but one computational or factoring error is made.

<p align="center">or</p>

[1] Appropriate work is shown, but one conceptual error is made.

<p align="center">or</p>

[1] $0, \dfrac{5}{2}$ but a method other than algebraic is used.

<p align="center">or</p>

[1] $0, \dfrac{5}{2}$ but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

8 The results of a poll of 200 students are shown in the table below:

	54	25	27
	36	40	18

For this group of students, do these data suggest that gender and preferred music styles are independent of each other? Justify your answer.

9 For the function $f(x) = (x-3)^3 - 1$, find $f^{-1}(x)$.

Key: $(x - 1)^{\frac{1}{3}} + 3$

Measures CCLS Cluster: F-BF.B

Mathematical Practice: 7

Commentary: This question measures F-BF.B because students must write the inverse of a given function.

Rationale:
$$x = (y - 3)^3 + 1$$
$$x - 1 = (y - 3)^3$$
$$(x - 1)^{\frac{1}{3}} = \left((y - 3)^3\right)^{\frac{1}{3}}$$
$$(x - 1)^{\frac{1}{3}} = y - 3$$
$$(x - 1)^{\frac{1}{3}} + 3 = y$$
$$f^{-1}(x) = (x - 1)^{\frac{1}{3}} + 3$$

Rubric:

[2] $(x - 1)^{\frac{1}{3}} + 3$ or an equivalent expression and correct work is shown.

[1] Appropriate work is shown, but one computational error is made.
<p align="center">*or*</p>
[1] Appropriate work is shown, but one conceptual error is made.
<p align="center">*or*</p>
[1] $x = (y - 3)^3 + 1$ is written, but no further correct work is shown.
<p align="center">*or*</p>
[1] $(x - 1)^{\frac{1}{3}} + 3$, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

10 Given: $h(x) = \frac{2}{9}x^3 + \frac{8}{9}x^2 - \frac{16}{13}x + 2$

$k(x) = |0.7x| + 5$

State the solutions to the equation $h(x) = k(x)$, rounded to the *nearest hundredth*.
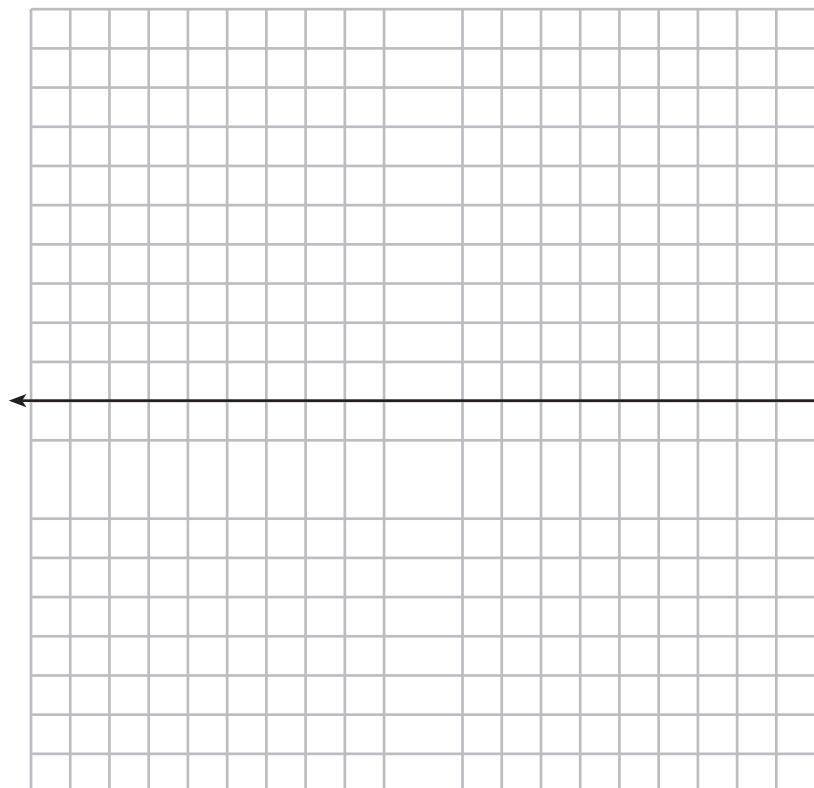
Key: –5.17, –1.13, and 1.75.

Measures CCLS Cluster: A-REI.D

Mathematical Practice: 5, 6

Commentary: This question measures A-REI.D because students are required to find the approximate solutions to $h(x) = k(x)$.

Rationale: Using technology and $y_1 = h(x)$ and $y_2 = k(x)$, the intersect function is used to determine all values of x for which $y_1 = y_2$.

On their calculator screens, students should see an image similar to the one below.

Rubric:

[2] −5.17, −1.13, and 1.75.

[1] One computational or rounding error is made.

or

[1] One conceptual error is made.

or

[1]

11 Algebraically prove that the difference of the squares of any two consecutive integers is an odd integer.

Key: See rationale below.

Measures CCLS Cluster: A-APR.C

Mathematical Practice: 1, 8

Commentary: This question measures A-APR.C beca   s must prove a polynomial identity.

Rationale: Let x the first integer

x 1   the next integer

The difference of their squares is

x 1 ^{2} x^2 x^2 $2x$ 1 x^2 $2x$ 1

$2x$ is an even integer, therefore $2x$ 1 is an odd int

or

x^2 x 1 ^{2} x^2 x^2 $2x$ 1 $2x$ 1   032.0012110.00x0.00020.002130.47101717201122

12 Rewrite the expression $\left(4x^2 + 5x\right)^2 - 5\left(4x^2 + 5x\right) - 6$ as a product of four linear factors.

Key: See rationale below.

Measures CCLS Cluster: A-SSE.A

Mathematical Practice: 1, 2, 7

Commentary: This question measures A-SSE.A because students produce an equivalent form of an expression.

Rationale: The problem is of the form $y^2 \quad 5y \quad 6$, which factors to $y \quad 6 \quad y \quad 1$. Therefore:

$$4x^2 \quad 5x \quad ^2 \quad 5 \ 4x^2 \quad 5x \quad 6$$

$$4x^2 \quad 5x \quad 6 \ 4x^2 \quad 5x \quad 1$$

$$4x \quad 3 \quad x \quad 2 \ 4x \quad 1 \quad x \quad 1$$

Rubric:

[2] $4x \quad 3 \quad x \quad 2 \ 4x \quad 1 \quad x \quad 1$ and correct work is shown.

[1]   6[Span9x2C14908BDEMC3BDCf4TP281 wrba0 Td(3) Span MCID 18 BDC TT2 1 Tf-$4

Key: $k \approx 0.066, T \approx 325 - 257e^{-0.066t}, 163$

Measures CCLS Cluster: A-CED.A

Mathematical Practice: 1, 4

Rubric:

[4] $k = 0.066, T = 325 - 257e^{-0.066t}$, 163, and correct work is shown.

[3] Appropriate work is shown, but one computational or rounding error is made.

or

[3] Appropriate work is shown, $T = 325 - 257e^{-0.066t}$ is written, but no further correct work is shown.

or

[3] Appropriate work is shown, but the equation is written without T or t.

[2] Appropriate work is shown, but two or more computational or rounding errors are made.

or

[2] Appropriate work is shown, but one conceptual error is made.

or

[2] Appropriate work is shown to find $k = 0.066$, but no further correct work is shown.

or

[2] The expression $325 - 257e^{-0.066t}$ is written, but no further correct work is shown.

[1] Appropriate work is shown, but one conceptual and one computational or rounding error is made.
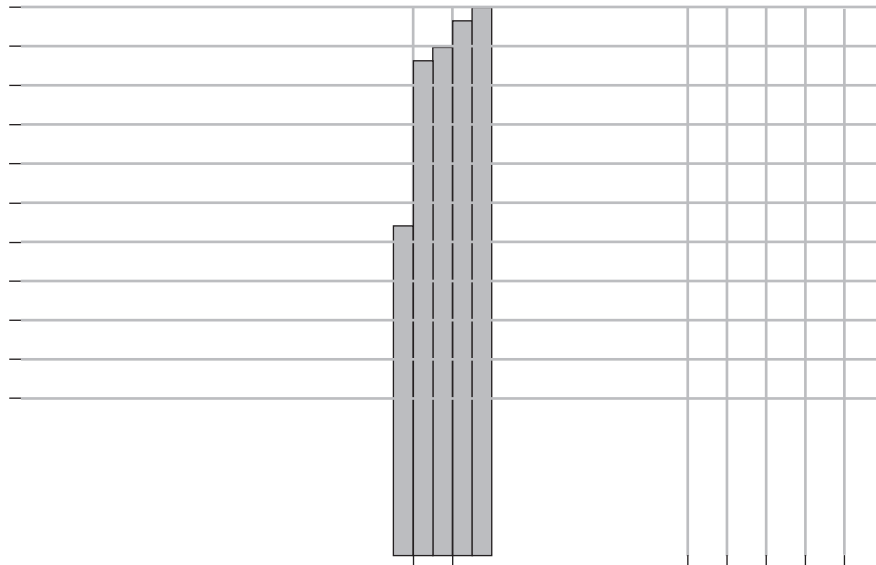
or

[1] 0.066, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

14 Seventy-two students are randomly divided into two equally-sized study groups. Each member of the first group (group 1) is to meet with a tutor after school twice each week for one hour. The second group (group 2), is given an online subscription to a tutorial account that they can access for a maximum of two hours each week. Students in both groups are given the same tests during the year.

A summary of the two groups' final grades is shown below:

$\bar{x}$ 830x$\bar{x}$.80/1614 47		83.8
S		

Key: See rationale below.

Rubric:

[4] −3.64 and a correct explanation, and yes and a correct explanation is given.

[3] Appropriate work is shown, but one computational error is made.

or

[3] Appropriate work is shown, but the mean difference is calculated incorrectly.

[2] Appropriate work is shown, but one conceptual error is made.

or

[2] Appropriate work is shown, but two or more computational errors are made.

or

[2] −3.64 and a correct explanation, but no further correct work is shown.

[1] −3.64, but no work is shown.

[0] Yes, but no explanation is given.

or

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

15 Given $z = x = 6x^3 = bx^2 = 52x = 15, z = 2$

Key: $\dfrac{3}{2}, \dfrac{1}{3}$ and $\ 5$

Measures CCLS Cluster: A-APR.B

Mathematical Practice: 1, 7

Commentary: This question measures A-APR.B because students must apply the Remainder Theorem and then identify the zeros of a polynomial when a suitable factorization is available.

Rationale: Find b:

$35 \quad 6 \cdot 2^{3} \quad b \cdot 2^{2} \quad 52 \cdot 2 \quad 15 \qquad\qquad 0 \quad 6 \cdot 5^{3} \quad b \cdot 5^{2} \quad 5\cdot$

$35 \quad 48 \quad 4b \quad 104 \quad 15$

$35 \quad 41 \quad 46 \qquad\qquad\qquad$ or $\qquad\begin{array}{l} 0 \quad 475 \quad 25b \\ 475 \quad 25b \\ 19 \quad b \end{array}$

$76 \quad 4b$

$19 \quad b$

$z \quad x \quad 6x^{3} \quad 19x^{2} \quad 52x \quad 15$

$z \quad 5 \quad 0$, by the Remainder Theorem;

$$
\begin{array}{r|rrrr}
5 & 6 & 19 & 52 & 15 \\
  &   & 30 & 55 & 15 \\
\hline
  & 6 & 11 & 3 & 0 \\
\end{array}
$$

$6x^{2} \quad 11x \quad 3 \quad 0$

$6x^{2} \quad 9x \quad 2x \quad 3 \quad 0$

$3x \; 2x \quad 3 \quad 1 \; 2x \quad 3 \quad 0$

$2x \quad 3 \quad 3x \quad 1 \quad 0 \qquad z \quad 5 \quad 0$

$$
\begin{array}{l|l|l}
2x \quad 3 \quad 0 & 3x \quad 1 \quad 0 & z \quad 5 \quad 0 \\
x \quad \dfrac{3}{2} & x \quad \dfrac{1}{3} & x \quad 5 \\
\end{array}
$$

Rubric:

[4] $\dfrac{3}{2}, \dfrac{1}{3},$ and 5, and correct algebraic work is shown.

[3] Appropriate work is shown to find $\dfrac{3}{2}$ and $\dfrac{1}{3}$, only.

or

[3] Appropriate work is shown, but one computational error is made.

[2] Appropriate work is shown, but two or more computational errors are made.

− −

16 Two versions of a standardized test are given, an April version and a May version. The statistics for the April version show a mean score of 480 and a standard deviation of 24. The statistics for the May version show a mean score of 510 and a standard deviation of 20. Assume the scores are normally distributed.

Joanne took the April version and scored in the interval 510-540. What is the probability, to the *nearest ten thousandth*, that a test paper selected at random from the April version scored in the same interval?
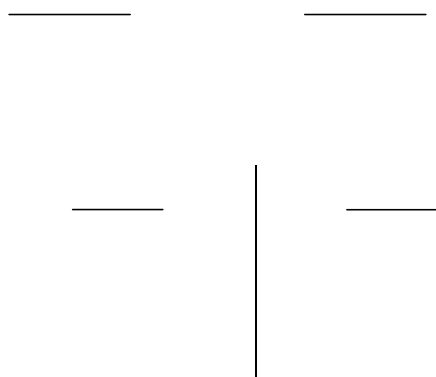
Maria took the May version. In what interval must Maria score to claim she scored as well as Joanne?

Key: See rationale below.

Measures CCLS Cluster: S-ID.A

Mathematical Practice: 1, 3, 5

Commentary: This question measures S-ID.A because students must be able to use their calculators

_____   _____

_____ | _____

17 Titanium-44 is a radioactive isotope such that every 63 years, its mass decreases by half. For a sample of titanium-44 with an initial mass of 100 grams, write a function that will give the mass of the sample remaining after any amount of time. Define all variables.

Scientists sometimes use the average yearly decrease in mass for estimation purposes. Use the average yearly decrease in mass of the sample between year 0 and year 10 to predict the amount of the sample remaining after 40 years. Round your answer to the *nearest tenth*.

Is the actual mass of the sample or the estimated mass greater after 40 years? Justify your answer.

Key: See rationale below.

Measures CCLS Cluster: F-BF.A

Mathematical Practice: 2, 4

Commentary: This question measures F-BF.A because students must write a function that describes a relationship between two quantities. This question also measures F-IF.B because students must calculate and interpret the average rate of change of a function.

Rationale:

                                   —

            _____   _____

                                   —

Rubric:

[6] A correct function with defined variables is written, 58.3, actual, and a correct justification is given.

[5] Appropriate work is shown, but one computational error is made.
or
[5] Appropriate work is shown, but the function's variables are not defined.

[4] Appropriate work is shown, but two computational errors are made.
or
[4] Appropriate work is shown, but one conceptual error is made.
or
[4] Appropriate work is shown to find 58.3, actual, and a correct explanation are stated, but no further correct work is shown.

[3] Appropriate work is shown, but three or more computational errors are made.
or
[3] Appropriate work is shown, but one conceptual and one computational error is made.
or
[3] A correct function and 58.3 are stated, but no further correct work is shown.

[2] Appropriate work is shown, but two conceptual errors are made.
or
[2] Appropriate work is shown, but one conceptual and two or more computational errors are made.
or
[2] A correct function is written with defined variables, but no further correct work is shown.

[1] Appropriate work is shown, but two conceptual and one computational errors are made.
or
[1] 58.3, but no work is shown.

[0] Actual, but no work is shown.
or
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.