Name _____

Minnesota Comprehensive Assessments-Series III

Mathematics Item Sampler
Grade 11

Minnesota Department of
Education

Grade 11 Formula Sheet

You may use the following formulas to solve problems on this test.

Pythagorean Theorem	$a^2 + b^2 = c^2$
Distance formula	$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
Quadratic formula	$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Trigonometric Relations	$\sin \theta = \dfrac{\text{opposite}}{\text{hypotenuse}} \qquad \cos \theta = \dfrac{\text{adjacent}}{\text{hypotenuse}}$ $\tan \theta = \dfrac{\text{opposite}}{\text{adjacent}}$
$A = \pi r^2$ $C = \pi d$	A = area C = circumference d = diameter r = radius
$SA = ph + 2B$ $SA = \pi r l + \pi r^2$ $SA = 4\pi r^2$	SA = surface area B = area of base h = height p = perimeter r = radius l = slant height
$V = Bh$ $V = \frac{1}{3} Bh$ $V = \frac{4}{3} \pi r^3$	V = volume B = area of base h = height r = radius

Mathematics Test
General Directions

- This test contains four segments.

- You may write in this test book as scratch paper. Grid paper is also provided at the back of the test book.

- You will find a formula sheet at the beginning of this test book. You may tear it out of your test book to use while taking the test.

- For each question, choose the answer you think is best.

- Look at the samples that show how to answer the questions.

Sample Question Answered in Test Book:

$$20 - 8 =$$

- **A.** 8
- **B.** 10
- Ⓒ 12
- **D.** 16

Sample Question Answered in Test Book:

$$4 - 12 = -8$$

- You **may** use a calculator for all segments.

- When you finish a segment of the test, stop and check your answers. Then use the sticker given to you to seal it. Once you seal a segment, you cannot go back to it. Each segment must be sealed before you move on to the next segment.
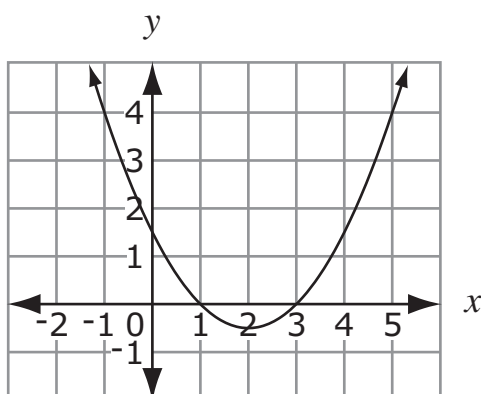
STOP

Mathematics Test — Segment 1

1. The population of a type of bacteria doubles every 3.5 hours. Which expression is a reasonable approximation of how many bacteria there will be in 20 hours for an initial population, *P*, of bacteria?

   A. *P*

   B. 2*P*

   C. 50*P*

   D. 64*P*

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2. The graph of $y=f(x)$ is shown.

What is a value of *x* for which $f(x)=4$?

   A. 1

   B. 1.5

   C. 4

   D. 5

3. How many solutions does $x - 2 = \sqrt{x}$ have?

    A. 0

    B. 1

    C. 2

    D. 4

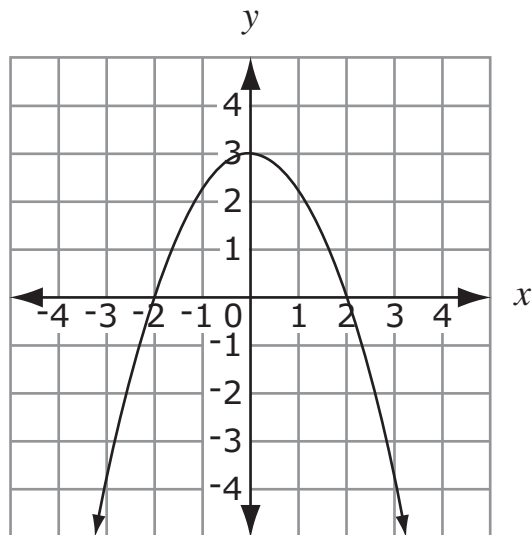**4.** For which equation is y a function of x?

    A. $y = \dfrac{5}{x-1}$

    B. $|y| = x - 8$

    C. $y^2 = x - 2$

    D. $y^2 = 4 - x^2$

5. What is the domain of $f(x) = \dfrac{x}{2x^2 - 5x - 3}$?

    A. $\{\, x \mid -\infty < x < \infty \,\}$

    B. $\{\, x \mid x \neq 0 \,\}$

    C. $\{\, x \mid x \neq -\frac{1}{2},\ x \neq 3 \,\}$

    D. $\{\, x \mid x \neq -3,\ x \neq \frac{1}{2} \,\}$

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6. The graph of a function is shown.

Which statement is true about the rate of change for this function when $-3 < x < 0$?

    A. The rate of change is constant.
    B. The rate of change is decreasing.
    C. The rate of change is increasing.
    D. The rate of change is negative.

7. Emma takes a job with a starting salary of $42,000. Her salary increases by 4% at the beginning of each year. What will be Emma's salary, to the nearest thousand dollars, at the beginning of year 10?

   A. $57,000

   B. $59,000

   C. $60,000

   D. $62,000

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8. Divide.

$$(2x^3 + 9x^2 - 11x - 24) \div (x - 2)$$

What is the remainder?

   A. 0

   B. 2

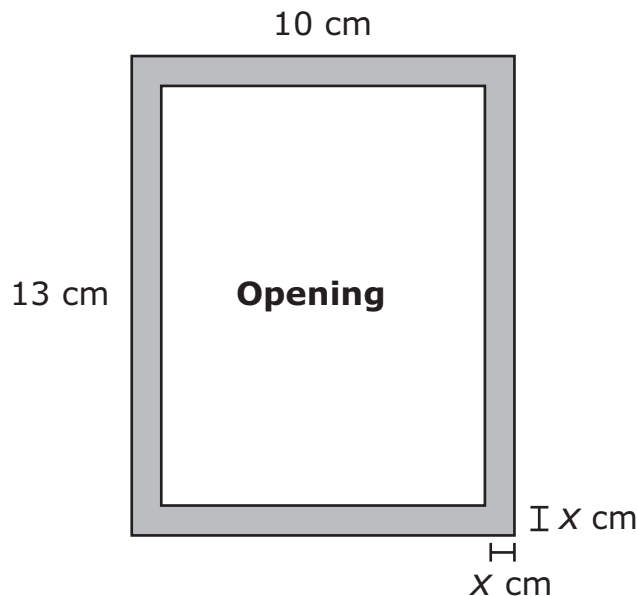   **C.** 6

   D. 18

Go on to the next page.

9. A root of function $f(x)$ is $-1-2i$. Which could be an equation for this function?

    A. $f(x)=x^2-2x-3$
    B. $f(x)=x^2-2x+5$
    C. $f(x)=x^2+2x-3$
    D. $f(x)=x^2+2x+5$

Please write your answer in the space below the question. You may use the digits: 0-9 and the symbols: slash for a fraction bar (/), a decimal (.) and a negative sign (-).

10. Tuan wants to make the rectangular frame shown.

10 cm

13 cm   **Opening**

x cm

x cm

It will be 10 centimeters wide and 13 centimeters long. He wants his frame to have a uniform width, x, and a rectangular opening. For what value of x is the area of the opening inside the frame $70\,\text{cm}^2$?

11. A scientist begins an experiment with 800 bacteria cells. After each 10-hour period, only $\frac{1}{2}$ the bacteria cells remain. Let t be the number of hours since the beginning of the experiment. Which equation could be used to represent the situation when only 200 bacteria cells remain?

A. $800(0.05)^t = 200$

B. $800(0.5)^{\frac{t}{10}} = 200$

C. $800(0.5)^{\frac{10}{t}} = 200$

D. $800(0.5)^{10t} = 200$

12. Which number is an extraneous solution of the equation $x = \sqrt{x + 6}$?
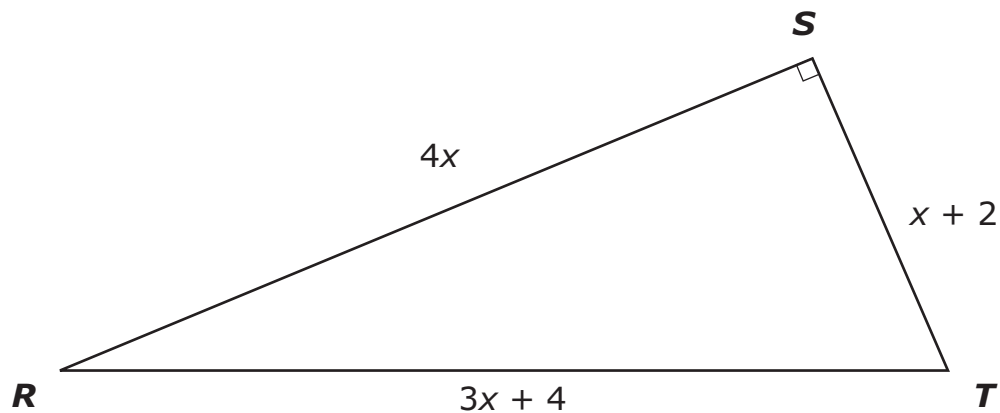
A. −6

B. −2

C. 0

D. 3

Mathematics Test — Segment 2

13. The surface area of a baseball is 177 cm^2. What is the diameter of the baseball? (Use 3.14 for π.)

   A. 3.75 cm

   B. 7 cm

   C. 7.5 cm

   D. 14.1 cm

2

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14. Triangle *RST* is shown.

How many units long is $\overline{RS}$?

   A. 2

   B. 3

   C. 4

   D. 12

15. Line *m* is parallel to line *n*.

Not drawn to scale
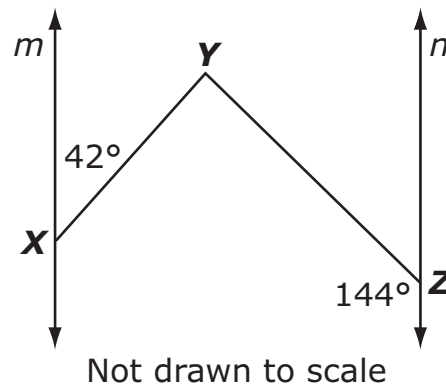
What is the measure of ∠*XYZ*?

A. 36°

B. 42°

C. 78°

D. 102°

Please write your answer in the space below the question. You may use the digits: 0-9 and the symbols: slash for a fraction bar (/), a decimal (.) and a negative sign (-).

16. Roads connecting the towns of Oceanside, River City, and Lake View form a triangle. The distance from Oceanside to River City is 38 kilometers. The distance from River City to Lake View is 26 kilometers. What is the smallest possible whole number of kilometers between Lake View and Oceanside?

17. In figure *RSTU*, $\overline{RT}$ and $\overline{SU}$ intersect at point *M*, so that $\overline{RM} \cong \overline{TM}$ and $\overline{RS}$ is parallel to $\overline{TU}$. Which additional information is needed to prove that figure *RSTU* is a rectangle?

    A. $\overline{RU} \cong \overline{RS}$

    B. $\overline{UM} \cong \overline{MS}$

    C. $\angle RST \cong \angle STU$

    D. $\angle RUT \cong \angle TSR$

2

Please write your answer in the space below the question. You may use the digits: 0-9 and the symbols: slash for a fraction bar (/), a decimal (.) and a negative sign (-).
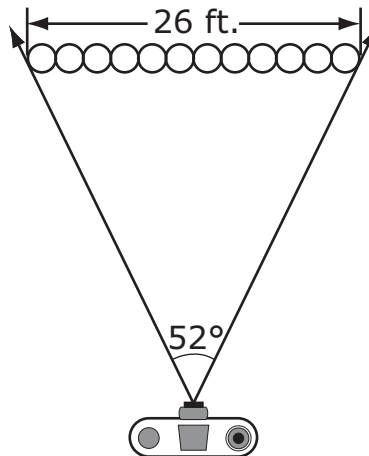
18. Maggie and Wei are measuring the distance across a circular fountain indirectly as shown in the diagram.
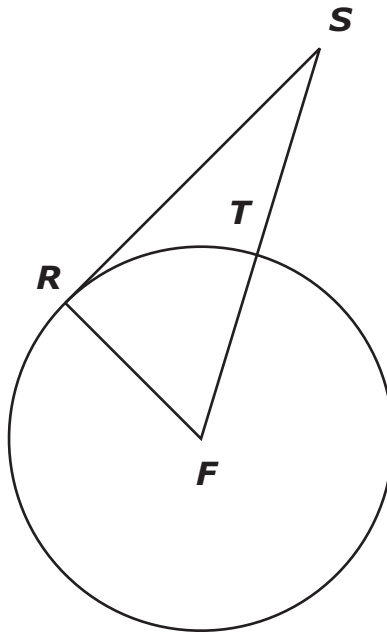
They find that the length of $\overline{RS}$ is 15 meters and the length of $\overline{ST}$ is 9 meters. $\overline{RS}$ is tangent to circle *F* and point *T* is on $\overline{FS}$. To the nearest meter, what is the diameter of the fountain?

19. Twelve students are lined up to have their class picture taken.

The photographer's camera has a picture angle of 52°. The picture angle limits the width of the photo that can be taken. The line of students is approximately 26 feet long. About how far must the photographer be from the line of students in order to center all 12 students in the picture?

A. 15 feet

B. 27 feet

C. 30 feet

D. 53 feet

20. An archaeologist used string to make a grid over an area where she was digging. She discovered a bowl buried at (1, 4) and a tool at (3, 10) on her grid. She suspected that an item was buried at the midpoint of the segment connecting the bowl and the tool. At which position on her grid should the archaeologist dig to look for the buried item?

A. (1, 3)

B. (2, 7)

C. $\left(\dfrac{5}{2}, \dfrac{13}{2}\right)$

D. (4, 14)

2

Please write your answer in the space below the question. You may use the digits: 0-9 and the symbols: slash for a fraction bar (/), a decimal (.) and a negative sign (-).

21. A group of health care providers consists of 4 doctors, 3 dentists, and 5 nurses. How many combinations of 2 health care providers of different types are possible?

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22. Isabella flipped a fair coin 100 times. Which statement about Isabella's outcomes is most likely true?

A. The coin landed heads up 50 times and tails up 50 times.

B. The number of times the coin landed heads up was less than 50.

C. If Isabella continues to flip the coin, the experimental probability of the coin landing heads up will increase.

D. If Isabella continues to flip the coin, the experimental probability of the coin landing heads up will approach $\dfrac{1}{2}$.

Please write your answer in the space below the question. You may use the digits: 0-9 and the symbols: slash for a fraction bar (/), a decimal (.) and a negative sign (-).

23. Eli receives a shipment of 40 new books for his bookstore: 5 biographies, 12 mysteries, 10 romances, 11 technical books, and 2 cookbooks. Eli randomly picks 2 books from the shipment. What is the probability that he picks a biography first and then picks a technical book?

2

24. Reginald is designing an outdoor art exhibit. He needs a metal equilateral triangle that measures 40 inches on each side. He wants to cut the triangle from a rectangular piece of metal that is 40 inches long. What is the minimum width of the rectangle Reginald needs to be able to cut out the triangle?

A. $\dfrac{20\sqrt{3}}{3}$ inches

B. $20\sqrt{2}$ inches

C. $20\sqrt{3}$ inches

D. 40 inches
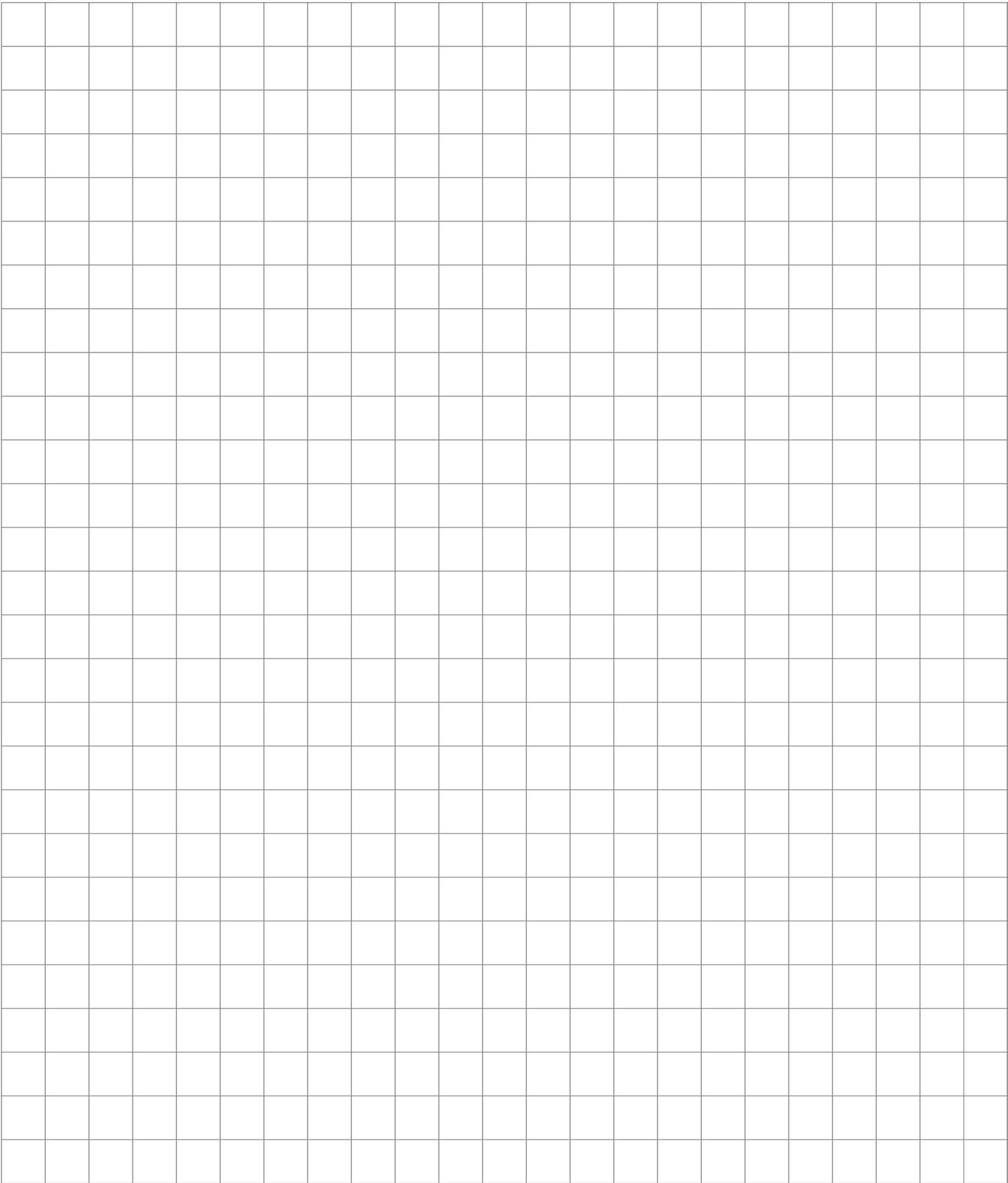
Grade 11 Teacher's Guide

Mathematics MCA Item Sampler Answer Key
Grade 11 Math

Item #	Correct Answer	Item Type	Strand	Standard	Benchmark
1	C	MC	2	4	08
2	D	MC	2	1	01
3	B	MC	2	3	07
4	A	MC	2	1	02
5	C	MC	2	1	03
6	B	MC	2	1	08
7	C	MC	2	2	05
8	C	MC	2	3	02
9	D	MC	2	3	05
10	Grid	GR	2	4	01
11	B	MC	2	4	02
12	B	MC	2	4	07
13	C	MC	3	1	01
14	D	MC	3	4	07
15	C	MC	3	3	01
16	Grid	GR	3	3	03
17	C	MC	3	3	07
18	Grid	GR	3	3	08
19	B	MC	3	4	02
20	B	MC	3	4	04
21	Grid	GR	4	3	01
22	D	MC	4	3	03
23	Grid	GR	4	3	05
24	C	MC	3	3	05

Grade 11 Teacher's Guide

Item # — The number of the question in the Item Sampler.

Correct Answer — Answers to multiple-choice questions are listed.

Item Type — Multiple Choice **(MC)** and Gridded Response **(GR)**

Strand — In mathematics, the MCA-III measures four strands:

1. Number and Operation
2. Algebra
3. Geometry and Measurement
4. Data Analysis and Probability

Standard — Each strand has one or more standards

Benchmark — Each standard has one or more benchmarks. See the Academic Standards or test specification for further explanation of each benchmark.