Mathematics – Algebra 2

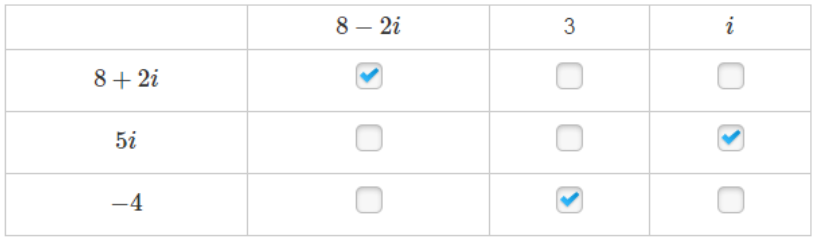
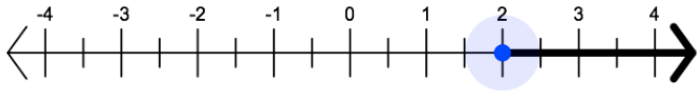
Practice Test Answer and Alignment Document

Online ABO

The following pages include the answer key for all machine-scored items, followed by the rubrics for the hand-scored items.

- The rubrics show sample student responses. Other valid methods for solving the problem can earn full credit unless a specific method is required by the item.
- In items where the scores are awarded for full and partial credit, the definition of partial credit will be confirmed during range-finding (reviewing sets of real student work).
- If students make a computation error, they can still earn points for reasoning or modeling.

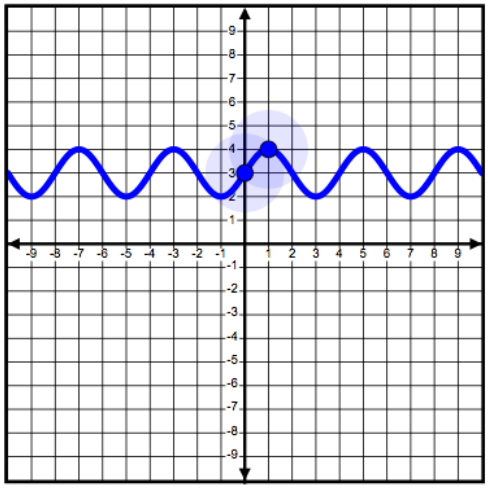
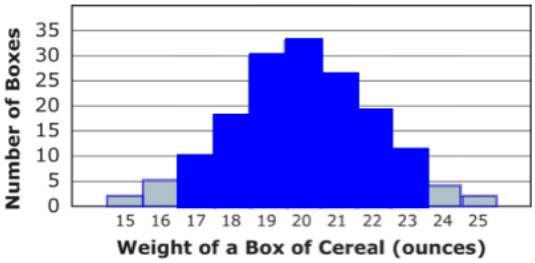
Unit 1

Item Number	Answer Key	Evidence Statement Key	Integrated Course Alignment
1.	**3**	A-APR.2	3
2.	**39**	A-REI.2	3
3.		N-CN.2	2
4.	**D**	N-RN.2	2
5.	**C**	A-REI.4b-2	2
6.		A-Int.1	3
7.	Part A: **D** Part B: **B, C, E**	A-SSE.2-6	3

8.	$a =$ 9 $b =$ -3 $c =$ 3 or $a =$ 9 $b =$ 3 $c =$ -3	A-SSE.2-3	3
9.	Part A: see rubric Part B: see rubric	HS.D.CCR	3
10.	$-\frac{3}{5}$ or equivalent	F-TF.8-2	3
11.	see rubric	HS.C.5.11	3
12.	From 2 seconds to 3 seconds | From 7 seconds to 8 seconds | From 0 seconds to 1 second Least … Greatest	F-IF.6-7	none
13.	Part A: $\frac{12}{23}$ or equivalent Part B: **D**	S-CP.Int.1	2
14.	**0.7 or 0.8**	A-REI.11-2	2
15.	see rubric	HS.D.2-13	3
16.	Part A: **D** Part B: **A**	F-IF.4-2	none

Unit 2

Item Number	Answer Key	Evidence Statement Key	Integrated Course Alignment
1.	$-8x^3$	F-BF.1b-1	2
2.	Even: $f(x)$ ●, $g(x)$ ○, $h(x)$ ●, $k(x)$ ○ Odd: $f(x)$ ○, $g(x)$ ○, $h(x)$ ○, $k(x)$ ● Neither Even nor Odd: $f(x)$ ○, $g(x)$ ●, $h(x)$ ○, $k(x)$ ○	F-BF.3-3	3
3.	Part A: see rubric Part B: see rubric	HS.C.CCR	3
4.	$\begin{cases} y = 1 - x^2 \\ y = x - 1 \end{cases}$: Two points of intersection ☑ $\begin{cases} y = 1 - x^2 \\ y = 1 \end{cases}$: One point of intersection ☑ $\begin{cases} y = 1 - x^2 \\ y = 2 - x \end{cases}$: No points of intersection ☑	A-REI.7	2

5.	Part A: **C** Part B: Because the survey is an observational study , the manager will not be able to establish a cause-and-effect relationship between gender and opinion.	S-IC.3-1	3
6.	Part A: **C** Part B: Suppose the investor wanted the balance in the account to be at least $12,000 at the end of 10 yea an annual interest rate of 5%, the amount of the yearly deposit should be at least $ 954.06 .	A-SSE.4-2	3
7.	see rubric	HS.C.17.2	3
8.	The average rate of change is 52.04 dollars per year	F-IF.6-2	none
9.		F-IF.7e-2	3
10.	Part A: **C** Part B: **C**	S-ID.6a-1	2
11.	Part A: see rubric Part B: see rubric	HS.D.3-5	3
12.	**C, D**	F-BF.2	1
13.	Part A:  Part B: **B**	S-ID.4	3

Rubrics start on the next page.

Unit 1 #9 Part A	
Score	**Description**
4	Student response includes each of the following 4 elements: • Correct compost collection site (cheapest site) • Valid method for determining the cheapest site • Valid model for the cheapest site • Valid steps used to create model Sample Student Response: I calculated the cost per ton of compost for FW processing and Hayward Ecology. FW Processing: $(1.25 \times 12) \div 20 + 50 = 50.75$ Haward Ecology: $(1.25 \times 60) \div 20 + 36 = 39.75$ I did not need to calculate the cost per ton for Jasper Organics or Northwestern because they are both greater distances and have higher fees than Hayward Ecology. I also did not need to calculate the cost per ton for Milton Recycling because it has a greater distance and higher fee than FW processing. At 39.75 per ton, Hayward Ecology collection site is the cheapest option. To create my model for the cost of disposing food waste, I will multiply the cost per ton by the number of tons. So my model for Hayward Ecology is $C = 39.75x$ where C is the total cost and x is the number of tons of compost.
3	Student response includes 3 of the above elements.
2	Student response includes 2 of the above elements.
1	Student response includes 1 of the above elements.
0	Student response is incorrect or irrelevant.

Unit 1 #9 Part B	
Score	**Description**
2	Student response includes each of the following 2 elements: • Valid amount the city will save • Valid process shown to determine the answer Sample Student Response: Cost to send waste to landfill the previous year: 290,00 □ $75 = $21,750,000

	Cost for landfill program this year: $290{,}000 \cdot 0.90 = 261{,}000$ $261{,}000 \cdot \$75 = \$19{,}575{,}000$ Cost for one trip to compost site: $1.25(120) + 20(36) = \$870$ $\frac{29{,}000}{20} = 1{,}450$ compost trips for 10% of the waste $\$870 \cdot 1{,}450 = \$1{,}261{,}500$ $\$19{,}575{,}000 + \$1{,}261{,}500 = \$20{,}836{,}500$ $\$21{,}750{,}000 - \$20{,}836{,}500 = \$913{,}500$ The city will save \$913,500. Note: Calculations based on an incorrect answer from Part A can still earn full credit in Part B.
1	Student response includes 1 of the 2 elements.
0	Student response is incorrect or irrelevant.

Unit 1 #11 Rubric	
Score	**Description**
3	Student response includes each of the following 3 elements: • Description of one solution • Description of no solutions • Description of two solutions Sample Student Response: This component can be approached with at least three methods: the numeric method, graphical method, and algebraic method. Numeric method: The equation $f(x) = g(x)$ is a quadratic equation. A quadratic equation of this form can have zero real solutions. For example, if $f(x) = x^2$ and $g(x) = x - 4$, the equation has no real solutions because the discriminant of the equation $x^2 - x + 4 = 0$ is less than 0. A quadratic equation of this form can have one real solution. For example, if $f(x) = x^2$ and $g(x) = 2x - 1$, the equation has one real

	solution because the discriminant of the equation $x^2 - 2x + 1 = 0$ is equal to 0. A quadratic equation of this form can have two real solutions. For example, if $f(x) = x^2$ and $g(x) = 4x - 1$, the equation has two real solution because the discriminant of the equation $x^2 - 4x + 1 = 0$ is greater than 0. No other possibilities exist for the number of solutions of a quadratic equation because the number of real solutions of a polynomial of degree n is at most n. Graphical method: There are three graphical examples of where $f(x)$ and $g(x)$ intersect. An example of a parabola and a line that do not intersect (no solutions). An example of a parabola and a tangent line (1 solution). An example of a parabola and a line that intersects at two points (2 solutions). There are no other ways to intersect a parabola and a line. Algebraic method: $f(x) = g(x)$ $ax^2 = mx + b$ $ax^2 - mx - b = 0$, Since the polynomial has degree 2 (the highest exponent of x), it either has 0, 1, or 2 solutions. We can find the number of solutions by examining the discriminant, which in this case is the quantity $(-m)^2 - 4(a)(-b)$. If the discriminant is negative, there are no real solutions. If the discriminant equals zero, there is exactly one real solution. If the discriminant is positive, there are two distinct real solutions. No other possibilities exist for the number of solutions of a quadratic equation because the number of real solutions of a polynomial of degree n is at most n. Note: The score is reduced by 1 point for each additional incorrect possible number of solutions, such as if the student says that it can have infinitely many solutions.
2	Student response includes 2 of the above elements.

1	Student response includes 1 of the above elements.
0	Student response is incorrect or irrelevant.

Unit 1 #15 Rubric	
Score	**Description**
3	Student response includes each of the following 3 elements: • Correct mean • Approximate probability that a male is taller than 74 inches • Valid work shown or explanation given Sample Student Response: Since 62 and 78 are centered about the mean, the mean height must be 70 inches. Then I used the empirical rule to determine 34% of the data are between 70 and 74. To determine the probability that a male student is taller than 74 inches, I subtracted 34 from 50 to get 16. Thus, approximately 16% of males are taller than 74 inches so the probability is 0.16.
2	Student response includes 2 of the above elements.
1	Student response includes 1 of the above elements.
0	Student response is incorrect or irrelevant.

Unit 2 #3 Part A Rubric	
Score	**Description**
2	Student response includes each of the following 2 elements: • Correct equation to determine the amount of money in the account over time • Correct mathematical approach or reasoning used to create the function Sample Student Response: From the information given, I know the initial deposit is \$500 and accrues simple interest annually. I also know that in 5 years, the account will have \$575 in it. $\$575 - \$500 = \$75$, which means over 5 years, the total interest the account accrues is \$75. $\$75.00 \div 5 = \$15.00$, which means every year the account accrues 15.00 in interest. Thus the function $s(t)$ would equal the initial deposit plus \$15.00 multiplied by the number of years the account is open. $s(t) = 500 + 15t$

1	Student response includes 1 of the 2 elements.
0	Student response is incorrect or irrelevant.

Unit 2 #3 Part B Rubric	
Score	**Description**
2	Student response includes each of the following 2 elements: • Correct minimum principal amount needed in the compound interest account (possibly based on an incorrect formula in Part A) • Valid work shown or explanation given Sample Student Response: Using the simple interest rate to determine the amount in the account after 10 years: $s(10) = 500 + 15(10)$ $s(10) = 650$ Using 3% as the compound interest and $t = 10$, $650 = P(1 + 0.03)^{10}$ $650 = P(1.03)^{10}$ $P \approx 483.66$ Starting with about \$483.66 in the compound interest savings account will yield about the same amount of money as depositing \$500 into the simple interest account for 10 years.
1	Student response includes 1 of the 2 elements.
0	Student response is incorrect or irrelevant.

Unit 2 #7 Rubric	
Score	**Description**
3	Student response includes each of the following 3 elements: • Correct identification of method • Valid explanation of the population about which a conclusion can be made • Valid explanation of an alternate method Sample Student Response: The students used a random sample survey method. The group can draw a valid conclusion about the population of students eating in the school cafeteria because their sample only includes students entering the school cafeteria. The group can still use a sample survey, but they can use a random sampling from the

	whole town rather than limiting the sample to the school cafeteria. Note: Other valid random sampling methods that would include people from the whole town are acceptable.
2	Student response includes 2 of the above elements.
1	Student response includes 1 of the above elements.
0	Student response is incorrect or irrelevant.

Unit 2 #11 Part A Rubric	
Score	**Description**
2	Student response includes each of the following 2 elements: • Correct conclusion that there is no significant difference between the distributions of the two groups • Correct justification Sample Student Response: There is no significant difference between the distributions of the heart rates for the two groups. The means, range, and distributions are nearly identical for the two groups.
1	Student response includes 1 of the 2 elements.
0	Student response is incorrect or irrelevant.
Unit 2 #11 Part B Rubric	
Score	**Description**
4	Student response includes each of the following 4 elements: • Correct conclusion about the difference between the two groups • Correct justification of the conclusion • Correct recommendation with support • Correct generalizability statement Sample Student Response: There appears to be a significant difference between the distributions of the heart rates for the two groups. The mean heart rate for the control group looks like it is lower than the experimental group. The range of the data is also smaller for the control group. I would recommend that males aged 40 – 45 use the traditional treadmill if they want to hit the target heart rate of 175 beats per minute. The mean results for the treadmill machine appears to be closer to 175 than the mean results for the elliptical machine. Because data was only collected at this one gym, results cannot

	be generalized to all males aged 40 – 45. The results of this study can only be applied to this particular gym.
3	Student response includes 3 of the 4 elements.
2	Student response includes 2 of the 4 elements.
1	Student response includes 1 of the 4 elements.
0	Student response is incorrect or irrelevant.