

Student Name _____



Maryland Comprehensive
Assessment Program

Algebra II
Test Booklet

Practice Test

Section 1

(Non-Calculator)

Directions:

Today, you will take Section 1 of the Algebra II Practice Test. You will not be able to use a calculator.

Read each question. Then, follow the directions to answer each question. Mark your answers by completely filling in the circles in your answer document. Do not make any pencil marks outside of the circles. If you need to change an answer, be sure to erase your first answer completely. If a question asks you to show or explain your work, you must do so to receive full credit. Only responses entered within the space provided will be scored.

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7. See below for examples on how to correctly complete an answer grid.

EXAMPLES

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- 1 Which number is equivalent to $(5 + i)^2$, where i is the imaginary unit?

Select one answer.

- A 24
- B $24 + 10i$
- C 26
- D $26 + 10i$

- 2 What are the solutions of the equation $\frac{x}{x+6} = \frac{2x-3}{x+12}$?

Select **all** that apply.

- A $x = -12$
- B $x = -6$
- C $x = -3$
- D $x = 0$
- E $x = \frac{3}{2}$
- F $x = 3$
- G $x = 6$

- 3** The recursive rule for a sequence is shown, where n represents a positive integer.

$$f(1) = 5$$

$$f(n) = 3 \cdot f(n - 1), \text{ for } n > 1$$

Which is an explicit rule for the sequence?

- A** $f(n) = 3(5)^{n-1}$, for $n \geq 1$
- B** $f(n) = 5(3)^{n-1}$, for $n \geq 1$
- C** $f(n) = 3 + 5(n - 1)$, for $n \geq 1$
- D** $f(n) = 5 + 3(n - 1)$, for $n \geq 1$
- 4** The binomial $(x - 2)$ is a factor of the polynomial function $P(x) = x^3 - x^2 + ax - 6$, where a is a constant.

What is the value of a ?

Enter your answer in the space provided.

- 5** Function f is defined as $f(x) = (0.5)^{2x}$.

Which statement correctly describes how the value of $f(x)$ is changing for every increase of 1 in the value of x ?

Select one answer.

- A** The value of $f(x)$ increases by 25%.
- B** The value of $f(x)$ decreases by 25%.
- C** The value of $f(x)$ increases by 75%.
- D** The value of $f(x)$ decreases by 75%.

- 6 An expression is shown.

$$\left(\frac{64}{27}\right)^{-\frac{1}{3}}$$

Using the properties of exponents, the expression can be rewritten as which of the fractions shown?

A $-\frac{4}{3}$

B $-\frac{3}{4}$

C $\frac{3}{4}$

D $\frac{4}{3}$

- 7 The function f is defined by $f(x) = 2x + 5$.

If $f(a) = c$, which of the following equations gives the value of a in terms of c ?

Select one answer.

A $a = 2c + 5$

B $a = 5c + 2$

C $a = \frac{c - 5}{2}$

D $a = \frac{c}{2} - 5$

- 8** The expression $x^3 - 3x^2 - 4x + 12$ can be written as $(x^2 - a)(x - b)$, where a and b are constants.

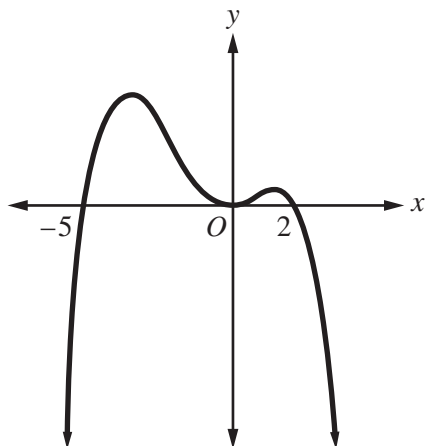
What are the values of a and b ?

- A** $a = 1$ and $b = 12$
- B** $a = 2$ and $b = 6$
- C** $a = 3$ and $b = 4$
- D** $a = 4$ and $b = 3$

- 9** Which value of x makes the equation $5(e)^{4x} = 25$ true?

- A** $x = \ln \frac{5}{4}$
- B** $x = \frac{1}{4} \ln 2$
- C** $x = \frac{1}{4} \ln 5$
- D** $x = \frac{1}{20} \ln 25$

- 10** The graph of a polynomial function is shown in the following xy -plane.

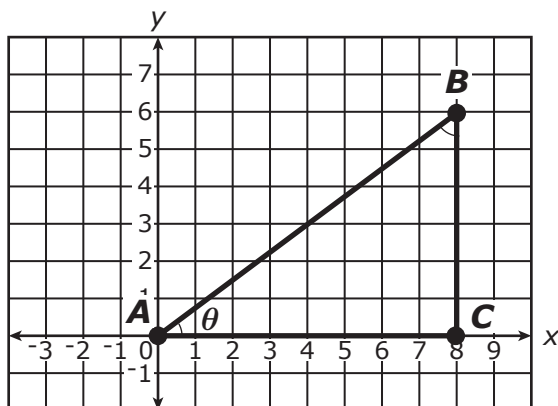


Which equation could represent the graph of the polynomial function?

Select one answer.

- A** $y = x^2(x + 5)(x - 2)$
- B** $y = -x^2(x + 5)(x - 2)$
- C** $y = x^2(x - 5)(x + 2)$
- D** $y = -x^2(x - 5)(x + 2)$

- 11** Right triangle ABC is shown in the xy -coordinate plane. Point B has coordinates $(8, 6)$.



Which statements are true?

Select **all** that apply.

A $\sin \theta = -\frac{4}{5}$

B $\sin \theta = \frac{3}{5}$

C $\sin \theta = \frac{4}{5}$

D $\sin(\pi + \theta) = -\frac{4}{5}$

E $\sin(\pi + \theta) = -\frac{3}{5}$

F $\sin(\pi + \theta) = \frac{3}{5}$

- 12** Which table shows the three quantities 4^7 , $(4^6)(4^2)$, and $9^{3.5}$ in order from **least** to **greatest**?

A

Least	$9^{3.5}$
	$(4^6)(4^2)$
Greatest	4^7

B

Least	$9^{3.5}$
	4^7
Greatest	$(4^6)(4^2)$

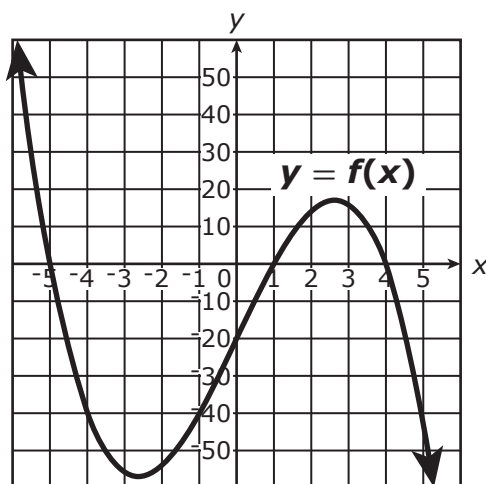
C

Least	4^7
	$9^{3.5}$
Greatest	$(4^6)(4^2)$

D

Least	4^7
	$(4^6)(4^2)$
Greatest	$9^{3.5}$

- 13** The graph of the polynomial function f is shown in the xy -coordinate plane.



Which of the equations shown could define f ?

- A** $f(x) = -(x + 5)(x - 1)(x - 4)$
- B** $f(x) = (x + 5)(x - 1)(x - 4)$
- C** $f(x) = -(x - 5)(x + 1)(x + 4)$
- D** $f(x) = (x - 5)(x + 1)(x + 4)$



Section 2

(Calculator)

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- 1** The table shows the percent of US households with computers for selected years between 1984 and 2003.

Percent of Households with Computers

Year	Percent
1984	8.2
1989	15.0
1993	22.9
1997	36.6
2000	51.0
2001	56.3
2003	61.8

Which of the equations shown **best** models the data in the table, where y is the percent of households with computers and x is the number of years after 1980?

- A** $y = 5.6(1.08)^x$
- B** $y = 5.6(1.09)^x$
- C** $y = 5.6(1.11)^x$
- D** $y = 5.6(1.14)^x$



2 The functions f and g are defined as shown.

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

$$g(x) = 0.5x^2 + 1$$

The values of x for which $f(x) = g(x)$ lie in which of the intervals shown?

Select **all** that apply.

A $-3 < x < -2$

B $-2 < x \leq -1$

C $-1 < x \leq 0$

D $0 < x \leq 1$

E $1 < x \leq 2$

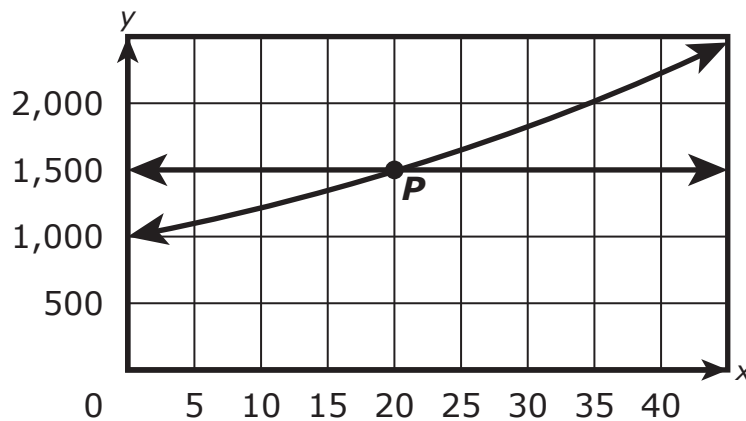
F $2 < x < 3$



- 3** An account that pays 0.5% interest was opened with an initial deposit, and no additional deposits to or withdrawals from the account were made. The equation $y = 1000(1.005)^{4x}$ models the amount, in dollars, in the account x years after it was opened.

The graph of the model and the graph of the equation $y = 1500$ are shown in the xy -coordinate plane.

The intersection of the two graphs is marked with the point P .



What is revealed by the coordinates of the point P ?

- A** the yearly interest rate for the account
- B** the amount of the initial deposit in the account
- C** the number of years it takes for the account value to reach \$1500
- D** the number of years it takes for the initial amount in the account to double



- 4** Claim: There is no quadratic equation with real coefficients for which $x = -5i$ is a solution.

Part A

Show that the claim is not correct by providing an example of a quadratic equation for which $x = -5i$ is a solution. Include any other solutions to your equation in your answer.

Enter your answer and your explanation in the space provided.

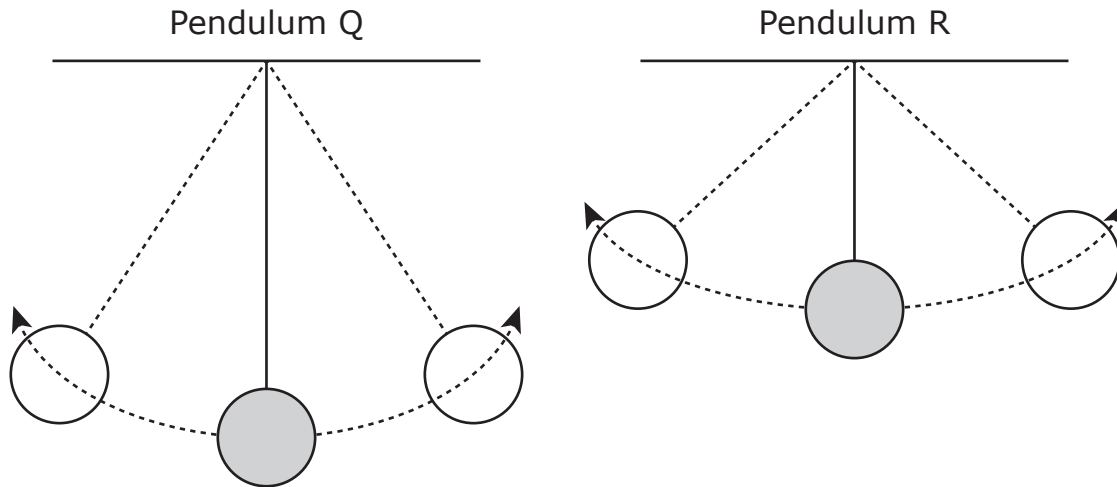
Part B

Is it possible for a quadratic equation with real coefficients to have $x = -5i$ as its **only** solution? Justify your answer.

Enter your answer and your justification in the space provided.



- 5 For the two pendulums shown, a weight swings back and forth from left to right. Both pendulums start at the left position at time $t = 0$ seconds.



For each pendulum, the horizontal distance, in inches, of the weight from the center position at time t seconds is given by functions Q and R , respectively. A negative distance represents the weight being to the left of the center position, and a positive distance represents the weight being to the right of the center position.

$$Q(t) = -6\cos(\pi t)$$

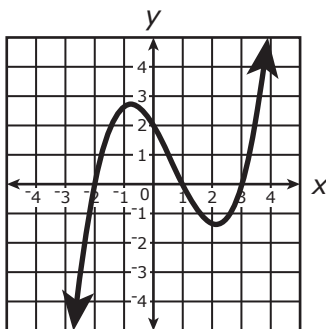
$$R(t) = -4\cos\left(\frac{4}{3}\pi t\right)$$

The maximum horizontal distance of pendulum Q to the right of its starting position is how much greater, in inches, than the maximum horizontal distance of pendulum R to the right of its starting position?

Enter your answer in the space provided.



- 6 Consider the polynomial function P , defined by $P(x) = x^3 + cx^2 + x + 2$, where c is a constant, and consider the graph shown in the xy -coordinate plane.



If $P(-2) = 0$, can the graph shown be the graph of $y = P(x)$?

- A** Yes, because c would equal -2 , and the points $(1, 0)$ and $(3, 0)$ would be on the graph of $y = P(x)$.
- B** Yes, because c would equal 2 , and the points $(1, 0)$ and $(3, 0)$ would be on the graph of $y = P(x)$.
- C** No, because c would equal -2 , and the points $(-2, 0)$ and $(3, 0)$ would not be on the graph of $y = P(x)$.
- D** No, because c would equal 2 , and the points $(1, 0)$ and $(3, 0)$ would not be on the graph of $y = P(x)$.



- 7** When a customer pays with a debit card at a clothing store, the owner pays a processing fee. The function P represents the processing fee, in dollars, for a debit card purchase of x dollars.

$$P(x) = 0.035x + 0.15$$

How is the processing fee calculated based on the purchase amount?

- A** The processing fee consists of a fixed amount of \$0.15 plus 0.35% of the purchase amount.
 - B** The processing fee consists of a fixed amount of \$0.15 plus 3.5% of the purchase amount.
 - C** The processing fee consists of a fixed amount of \$0.35 plus 1.5% of the purchase amount.
 - D** The processing fee consists of a fixed amount of \$0.35 plus 15% of the purchase amount.
- 8** An equation is shown.

$$\sqrt{x^2 + 19} - 100 = 0$$

What are the solutions of the equation?

- A** $x = 9$ only
- B** $x = 3\sqrt{1109}$ only
- C** $x = -9$ and $x = 9$
- D** $x = -3\sqrt{1109}$ and $x = 3\sqrt{1109}$





Section 3

(Calculator)

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<input type="radio"/> 3	<input type="radio"/> 3	<input type="radio"/> 3	<input type="radio"/> 3	<input type="radio"/> 3	<input type="radio"/> 3
<input type="radio"/> 4	<input type="radio"/> 4	<input type="radio"/> 4	<input type="radio"/> 4	<input type="radio"/> 4	<input type="radio"/> 4
<input type="radio"/> 5	<input type="radio"/> 5	<input checked="" type="radio"/>	<input type="radio"/> 5	<input type="radio"/> 5	<input type="radio"/> 5
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<input type="radio"/> 7	<input checked="" type="radio"/>	<input type="radio"/> 7	<input type="radio"/> 7	<input type="radio"/> 7	<input type="radio"/> 7
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- 1 The function C approximates the number of calories recommended per day for a dog, based on the weight, in pounds, of the dog.

The table gives values of C for selected values of p , where $C(p)$ represents the recommended number of calories per day for a dog that weighs p pounds.

Recommended Number of Calories for Dogs

p (pounds)	$C(p)$
11	250
22	450
33	750
44	1000
55	1250
66	1500
77	1700
88	1880

Which of the equations shown **most** closely approximates C ?

- A $C(x) = 18p + 22$
- B $C(x) = 22p + 18$
- C $C(x) = 40(1.06)^p$
- D $C(x) = 48(1.07)^p$



2 Claim: $\sqrt[3]{x} \leq x$, where x is a real number

For which intervals is the claim true for all values of x in the interval?

Select **all** that apply.

A $x > 1$

B $0 < x < 1$

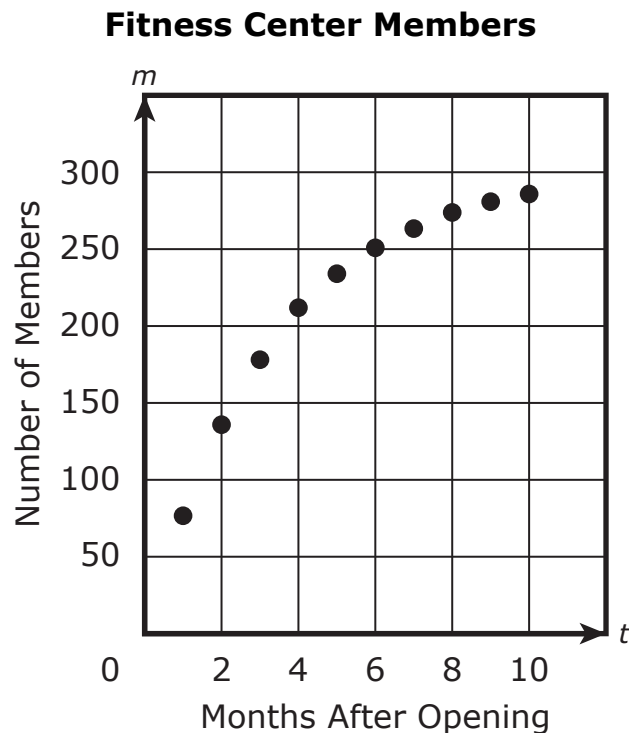
C $-1 < x < 0$

D $-2 < x < -1$

E $x < -2$



- 3** The number of members, m , that a new fitness center expects to have t months after the opening of the center is shown in the scatter plot.



The fitness center constructed the model $m(t) = 300 - 280(0.76)^t$ to project the number of members that can be accommodated t months after opening.

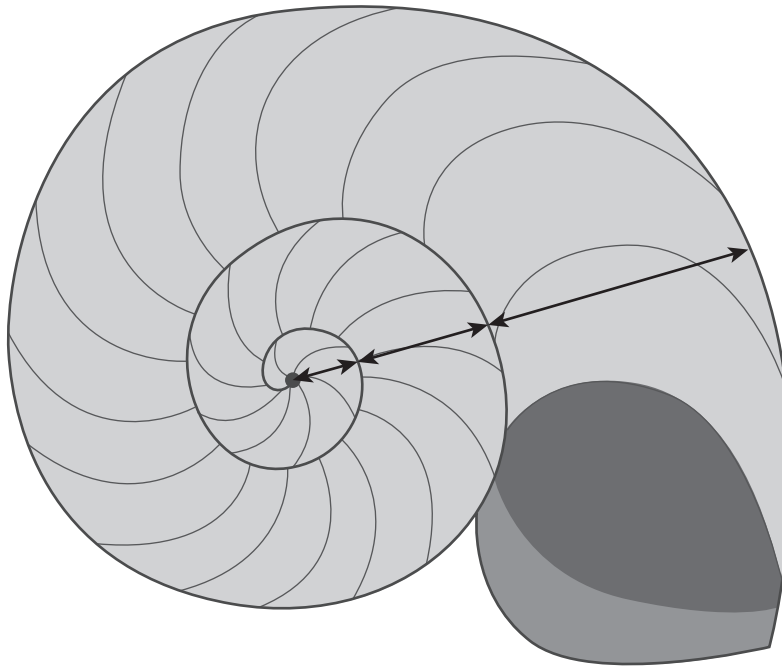
- What is the average rate of change, in members per month, in the number of members the fitness center expects to have from the 4th to the 8th month after opening? Show your work.
- What is the significance of the number 300 in the model? Explain your answer.

Enter your answers and your work and explanation in the space provided.



- 4 The students in a class are analyzing several examples of spirals in nature.

The students measured the distances shown in the picture for different shells.



Each student measured the three distances shown in the picture by starting from the outside of the shell and moving toward the center.

One student's measurements were 8.1 centimeters, 4.2 centimeters, and 2.1 centimeters. A second student's measurements of a different shell were 7.6 centimeters, 3.7 centimeters, and 1.8 centimeters.

Which equation could be used to model the students' data, where a represents the first measurement, in centimeters, and d represents the n th measurement, in centimeters, where $n = 1, 2$, or 3 ?

A $d = a\left(\frac{1}{2}\right)^{n-1}$

B $d = a(2^{n-1})$

C $d = a\left(\frac{1}{2}\right)^n$

D $d = a(2^n)$



- 5** Consider the functions P and Q , defined as shown.

$$P(x) = x^2 + 7x - 14$$

$$Q(x) = -3x + 10$$

In the xy -coordinate plane, what are the coordinates of the points at which the graphs of the equations $y = P(x)$ and $y = Q(x)$ intersect?

Explain how you determined your answer.

Enter your answer and your explanation in the space provided.

- 6** The approximate number of cars parked in a garage x hours after 6:00 a.m. can be modeled by the function $y = 180 + 130\sin(\frac{x}{12}\pi)$, where $0 \leq x \leq 16$.

Based on the model, for which time interval did the number of cars parked in the garage increase?

- A** 7:00 a.m. to 9:00 a.m.
- B** 1:00 p.m. to 4:00 p.m.
- C** 5:00 p.m. to 7:00 p.m.
- D** 8:00 p.m. to 10:00 p.m.





Section 4

(Calculator)

Directions:

Today, you will take Section 4 of the Algebra II Practice Test. You will be able to use a calculator.

Read each question. Then, follow the directions to answer each question. Mark your answers by completely filling in the circles in your answer document. Do not make any pencil marks outside of the circles. If you need to change an answer, be sure to erase your first answer completely. If a question asks you to show or explain your work, you must do so to receive full credit. Only responses entered within the space provided will be scored.

If you do not know the answer to a question, you may go on to the next question. If you finish early, you may review your answers and any questions you did not answer in this section ONLY. Do not go past the stop sign.



Directions for Completing the Answer Grids

1. Work the problem and find an answer.
2. Write your answer in the boxes at the top of the grid.
3. Print only one number or symbol in each box. Do not leave a blank box in the middle of an answer.
4. Under each box, fill in the circle that matches the number or symbol you wrote above. Make a solid mark that completely fills the circle.
5. Do not fill in a circle under an unused box.
6. Fractions cannot be entered into an answer grid and will not be scored. Enter fractions as decimals.
7. See below for examples on how to correctly complete an answer grid.

EXAMPLES

To answer -3 in a question, fill in the answer grid as shown below.

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To answer $.75$ in a question, fill in the answer grid as shown below.

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<input type="radio"/> 1	<input type="radio"/> 1	<input type="radio"/> 1	<input type="radio"/> 1	<input type="radio"/> 1	<input type="radio"/> 1	<input type="radio"/> 1
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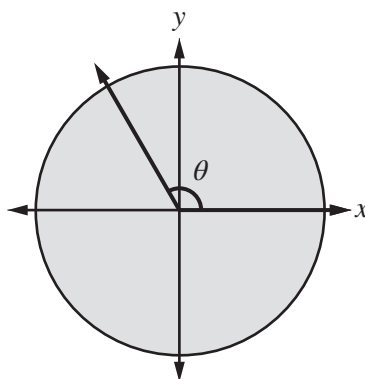
- 1** The half-life of the isotope Francium-223 is 22 minutes. For a sample that starts with F grams of Francium-223, the expression $F(0.5)^{\frac{m}{22}}$ represents the number of grams remaining after m minutes.

Which expression represents the number of grams of Francium-223 remaining after h hours?

- A** $F(0.151)^h$
- B** $F(0.5)^{\frac{h}{60}}$
- C** $F(0.5)^{60h}$
- D** $F(0.969)^h$



- 2** Angle θ is positioned in a circle with its initial ray on the positive x -axis and its terminal ray $\frac{1}{3}$ of one complete revolution about the origin, as shown in the following diagram.



Which of the following statements correctly expresses the measure of θ in both degrees and radians?

Select one answer.

- A** The measure of angle θ is 120 degrees or $\frac{\pi}{3}$ radians.
- B** The measure of angle θ is 120 degrees or $\frac{2\pi}{3}$ radians.
- C** The measure of angle θ is 150 degrees or $\frac{5\pi}{12}$ radians.
- D** The measure of angle θ is 150 degrees or $\frac{7\pi}{12}$ radians.
- 3** Claim: For every value of the constant c , the equation $x^4 + (1 - c^2)x^2 - c^2 = 0$ has at least two distinct real solutions.
- What value of c refutes the claim?
- Enter your answer in the space provided.



- 4 The table shows the box office revenue, in millions of dollars, for the first 10 weeks after a movie opened in theaters.

Box Office Revenue for a Movie

Number of Weeks after Opening	Box Office Revenue (in millions)
0	\$85.63
1	\$51.97
2	\$37.21
3	\$25.20
4	\$15.22
5	\$11.17
6	\$7.02
7	\$4.03
8	\$4.42
9	\$1.95

Part A

Create a function to model the data. Explain why you chose the type of function and explain the meaning of the parameters of the function.

Enter your answer and your explanation in the space provided.

Part B

The theaters will stop showing the movie when the weekly box office revenue is below \$100,000. In what week does your model predict that the theaters will stop showing the movie?

Show your work or explain how you found your answer.

Enter your answer and your work or explanation in the space provided.



- 5** Consider the equation $a = \sqrt{x + b}$, where a and b represent real numbers.

Which statement is true about the number of real solutions to the equation?

- A** The number of real solutions depends only on the value of a .
- B** The number of real solutions depends only on the value of b .
- C** The number of real solutions depends on the relationship between a and b .
- D** The values of a and b do not affect the number of real solutions.

- 6** The world population in 1997 was 5.88 billion.

The world population in 2017 was 7.53 billion.

Assume that the ratio between the population in two consecutive years was constant between 1997 and 2017.

Which equation can be used to find r , the rate of growth per year of the world population?

- A** $5.88 = 7.53r^{10}$
- B** $5.88 = 7.53r^{20}$
- C** $7.53 = 5.88r^{10}$
- D** $7.53 = 5.88r^{20}$



7 Consider the system of equations shown.

$$\begin{aligned}y &= (x - 3)^2 \\ y &= x - 1\end{aligned}$$

On the coordinate plane, what are the coordinates of the points that represent solutions (x, y) of the system?

- A** $(-5, -6)$ and $(-2, -3)$
- B** $(-5, -6)$ and $(2, 1)$
- C** $(5, 4)$ and $(-2, -3)$
- D** $(5, 4)$ and $(2, 1)$

8 A kitchen supply store sells a set of 4 food storage containers.

- From largest to smallest, the volumes of the containers are v_1, v_2, v_3 , and v_4 .
- v_n is 20% less than v_{n-1} , where n is 2, 3, or 4.
- $v_n = kv_{n-1}$, where n is 2, 3, or 4.

What is the value of k ?

- A** $\frac{3}{4}$
- B** $\frac{4}{5}$
- C** $\frac{5}{4}$
- D** $\frac{4}{3}$



Practice Test Answer and Alignment Document

Mathematics: Algebra II

Pencil-and-Paper

The following pages include the answer keys for all machine-scored items. A sample student response for the top score is included for all hand-scored constructed response items.

- Some answer keys include one possible sample student response. 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.

Section 1

Item Number	Answer Key	Evidence Statement Key/ Content Scope
1.	B	N-CN.A.2
2.	C, G	A-REI.A.2-1
3.	B	F-IF.A.3
4.	1	A-APR.B.2
5.	D	F-IF.C.8.b
6.	C	N-RN.A.2
7.	C	F-BF.B.4.a
8.	D	A-SSE.A.2.a
9.	C	F-LE.A.4
10.	B	A-APR.B.3
11.	B, E	F-TF.A.2
12.	B	N-RN.A.2

Item Number	Answer Key	Evidence Statement Key/ Content Scope
13.	A	F-IF.C.7.c

Section 2

Item Number	Answer Key	Evidence Statement Key/ Content Scope
1.	C	S-ID.B.6.a
2.	B, C, E	A-REI.D.11
3.	C	A2.M.4 A-REI.D.11
4.	<p><u>Sample Top Score Response</u></p> <p>Part A:</p> <p>A quadratic equation with real coefficients that has $x = -5i$ as a solution must also have $x = 5i$ as a solution. One such equation is $(x - 5i)(x + 5i) = 0$, which is equivalent to $x^2 + 25 = 0$.</p> <p>Part B:</p> <p>There is no quadratic equation with real coefficients that has $x = -5i$ as its only solution. If the only solution is $x = -5i$, then the quadratic equation is a multiple of $(x + 5i)^2 = 0$, which is equivalent to $x^2 + 10ix - 25 = 0$, and that equation cannot be equivalent to one with real coefficients because $\frac{10i}{-25}$ is not a real number.</p> <p>Refer to the Holistic Rubric for 4-Point Reasoning Constructed Response Items for score point information.</p>	A2.R.4 N-RN.A.2 N-CN.C.7
5.	2	A2.M.6 F-TF.B.5
6.	D	A2.R.10 A-APR.B.3
7.	B	F-LE.B.5-2
8.	D	A-REI.A.2-2

Section 3

Item Number	Answer Key	Evidence Statement Key/ Content Scope
1.	B	F-BF.A.1.a
2.	A, C	A2.R.6 N-RN.A.2
3.	<p><u>Sample Top Score Response</u></p> <p>An estimate for the number of members in the 4th month is 211. An estimate for the number of members in the 8th month is 273.</p> <p>Average rate of change:</p> $\frac{273 - 211}{8 - 4} = \frac{62}{4} = 15\frac{1}{2} \text{ members per month.}$ <p>The expression $280(0.76)^t$ approaches zero as t increases. So, $300 - 280(0.76)^t$ approaches 300 as t increases. Therefore, 300 is the maximum number of members.</p> <p>Refer to the Holistic Rubric for 4-Point Modeling Constructed Response Items for score point information.</p>	A2.M.4 F-IF.B.6-3 F-LE.B.5-1
4.	A	A2.M.5 F-BF.A.2

Item Number	Answer Key	Evidence Statement Key/ Content Scope
5.	<p><u>Sample Top Score Response</u></p> <p>The two graphs intersect at the points $(x, y) = (-12, 46)$ and $(x, y) = (2, 4)$.</p> <p>The x coordinates of the points of intersection of the graph are those points for which $P(x) = Q(x)$.</p> $P(x) = Q(x)$ $x^2 + 7x - 14 = -3x + 10$ $x^2 + 10x - 24 = 0$ $(x + 12)(x - 2) = 0$ $x = -12 \text{ or } x = 2$ <p>If $x = -12$, then $y = (-3)(-12) + 10 = 36 + 10 = 46$</p> <p>If $x = 2$, then $y = (-3)(2) + 10 = -6 + 10 = 4$</p> <p>Therefore, the points of intersection are $(x, y) = (-12, 46)$ and $(x, y) = (2, 4)$.</p> <p>Refer to the Holistic Rubric for 4-Point Reasoning Constructed Response Items for score point information.</p>	<p>A2.R.8 A-REI.D.11</p>
6.	A	F-IF.B.6-3

Section 4

Item Number	Answer Key	Evidence Statement Key/ Content Scope
1.	A	A-SSE.B.3.c
2.	B	F-TF.A.1
3.	0	A2.R.4 A-APR.B.3
4.	<p><u>Sample Top Score Response</u></p> <p>Part A: The function $f(x) = 84.16(0.66)^x$ models the data. An exponential function was chosen because the data seems to decrease rapidly at first, then level off a bit.</p> <p>The constant 84.16 represents the box office revenue, in million dollars, predicted by the function 0 weeks after the movie opened, that is, during the movie's opening week.</p> <p>The constant 0.66 means that the revenue is decreasing on average by $1 - 0.66 = 0.34$ or 34% each week.</p> <p>Part B: 100,000 is 0.1 million, so the time when the function has a value less than 0.1 should be determined. By graphing $y = 84.16(0.66)^x$ and $y = 0.1$ on the same graph, it can be seen that the least number of weeks after the movie opened when the function value is less than 0.1 is 16.</p> <p>Refer to the Holistic Rubric for 4-Point Modeling Constructed Response Items for score point information.</p>	A2.M.2 S-ID.B.6.a
5.	A	A2.R.1 A-REI.A.2-2
6.	D	A2.M.2 F-LE.A.2-1
7.	D	A-REI.C.7

Item Number	Answer Key	Evidence Statement Key/ Content Scope
8.	B	F-BF.A.2