York County School Division

Algebra I SOL Review
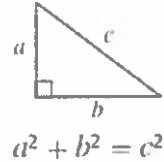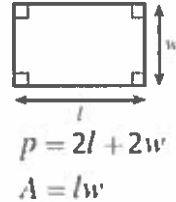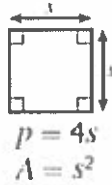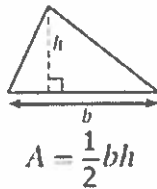
Student Name _____

Algebra SOL Test Date – _____

Revised July, 2012

Algebra I Formula Sheet
2009 *Mathematics Standards of Learning*

Geometric Formulas:

$$A = \frac{1}{2}bh$$

$$p = 4s$$
$$A = s^2$$

$$p = 2l + 2w$$
$$A = lw$$

$$a^2 + b^2 = c^2$$

Quadratic Formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}, \text{ where } ax^2 + bx + c = 0 \text{ and } a \neq 0$$

Statistics Formulas:

Given:

x represents an element of the data set,

x_i represents the ith element of the data set,

n represents the number of elements in the data set,

μ represents the mean of the data set, and

σ represents the standard deviation of the data set.

$$\text{variance } (\sigma^2) = \frac{\sum_{i=1}^{n}(x_i - \mu)^2}{n}$$

$$\text{standard deviation } (\sigma) = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \mu)^2}{n}}$$

$$\text{mean absolute deviation} = \frac{\sum_{i=1}^{n}|x_i - \mu|}{n}$$

$$\text{z-score } (z) = \frac{x - \mu}{\sigma}$$

Expressions and Operations

SOL A.1
The student will represent verbal quantitative situations algebraically and evaluate these expressions for given replacement values of the variables.

Hints and Notes

Order of Operations:
- Parentheses
- Exponents
- Multiplication and Division
- Addition and Subtraction

Key Words:

(+) addition, <u>sum</u>, increase, total

(-) subtraction, <u>difference</u>, minus, less, less than, decrease

(x) multiplication, <u>product</u>, times, twice(2), double(2)

(÷) division, <u>quotient</u>, into, half, shared

the word **THAN switches the order of words

TI-83 Help
- When substituting values for variables use ( )

- Always put negative #'s in ( )

PRACTICE A.1

1. Six less than the product of eight and a number

   A $6-8n$
   B $8-6n$
   C $6n-8$
   D $8n-6$

2. Find the value of $\dfrac{4b+12}{3a+2c}$ if $a=8, b=5,$ and $c=-4$.

   A -4
   B 2
   C 4
   D 16

3. The sides of a triangle have lengths $2x-1, x+5,$ and $3x-7$. Which of the following describes the perimeter of the triangle in terms of x?
   Hint: Perimeter = (side 1) + (side 2) + (side 3)

   A $P=6x-3$
   B $P=5x-3$
   C $P=6x-11$
   D $P=6x+3$

4. Simplify $4a-5(6+7a)$

   A $-39a-30$
   B $6a+1$
   C $-31a-30$
   D $39a-30$

5. Find the value of $6a^2$ for $a=3$
   A -54
   B 9
   C 36
   D 54

6. What is the value of $3x^2 - y^2$ if $x=1$ and $y=3$?

   A 12
   B -3
   C -6
   D -12

PRACTICE A.1 (Continued)

Put your answer in the box. These are open-ended questions. Work them out write your answer in the box (on the computer you would type your answer in the box being sure to put it in appropriate form, simplest fraction, decimal, etc.) For our purposes, you will write your answer in the box.

7. Simplify $\frac{3}{4}(12-4)+32 \div 4 \cdot (-6)$

8. Simplify $-|-10|+\frac{3-39}{4}$

9. Evaluate $\sqrt[3]{x}+y \cdot p$, when $x=8$, $y=-28$, and $p=\frac{1}{2}$

10. Evaluate $\frac{x^2+y^2}{x^2-y^3}$ when $x=-1$ and $y=-4$.

A.1 SKILLS CHECKLIST: *I can...*

☐ Translate verbal quantitative situations into algebraic expressions and vice versa.
☐ Model real-world situations with algebraic expressions in a variety of representations (concrete, pictorial, symbolic, verbal).
☐ Evaluate algebraic expressions for a given replacement set to include rational numbers
☐ Evaluate expressions that contain absolute value, square roots and cube roots.

SOL A.2
The student will perform operations on polynomials, including
a) applying the laws of exponents to perform operations on expressions;
b) adding, subtracting, multiplying, and dividing polynomials; and
c) factoring completely first- and second-degree binomials and trinomials in one or two variables. Graphing calculators will be used as a tool for factoring and for confirming algebraic factorizations.

HINTS AND NOTES

Product of Powers-same base
$$a^m \cdot a^n = a^{m+n}$$

Power of a Power
$$(a^m)^n = a^{m \cdot n}$$

Power of a Product
$$(ab)^m = a^m b^m$$

Quotient of a Power-same base
$$\frac{a^m}{a^n} = a^{m-n}$$

Power of a Quotient
$$\left(\frac{a}{b}\right)^x = \frac{a^x}{b^x}$$

Negative Exponents
$$x^{-a} = \frac{1}{x^a} \text{ or } \frac{1}{x^{-a}} = x^a$$

x^0 is always equal to 1

TI-83 CALCULATOR HELP:
- Remember your ( )
- ^ means exponent

PRACTICE A.2a

1. Simplify $(4b^3)(8b^2)$

   A $\quad 12b^2$

   B $\quad 32b^6$

   C $\quad 12b^5$

   D $\quad 32b^5$

2. Which expression represents the simplest form of $\dfrac{63a^2 bc}{9abc}$?

   A $\quad 7a$

   B $\quad 7ab$

   C $\quad 7abc$

   D $\quad 7a^2bc$

3. Simplify $(-2a^{15})$

   A $\quad -10a^{15}$

   B $\quad -2a^{15}$

   C $\quad 32a^{26}$

   D $\quad -32a^{15}$

4. Which is equivalent to $\dfrac{x^5 y^2 z^8}{(xy)^{-3}}$?

   A $\quad \dfrac{x^2 z^8}{y}$

   B $\quad x^{12} y^8 z^8$

   C $\quad x^8 y^5 z^8$

   D $\quad -1$

Highlight each correct answer. These questions give you choices. You must click on each correct answer and make sure you mark every answer that is correct. If you forget one, it will be incorrect. Circle each correct answer. More than one answer may be selected.

5. For the expression below, find values for *a, b, c, d, e,* and f so that the expression simplifies to $3x^2 y^3$. Choose all that apply.

$$\frac{ax^b y^c}{dx^e y^f}$$

| $\dfrac{6x^5 y^6}{2x^3 y^3}$ | $\dfrac{3x^{-4} y^{-5}}{x^{-6} y^{-8}}$ | $\dfrac{-9x^9 y^7}{3x^7 y^{-4}}$ | $\dfrac{12x^8 y^{10}}{4x^6 y^7}$ | $\dfrac{10x^5 y^6}{7x^{-3} y^{-3}}$ | $\dfrac{-15x^3 y^3}{-3x^5 y^6}$ |

Put your answer in the box. These are open-ended questions. Work them out write your answer in the box (on the computer you would type your answer in the box being sure to put it in appropriate form, simplest fraction, decimal, etc.) For our purposes, you will write your answer in the box.

6. Given a triangle with a height of $6ab^3$ and a base of $4a^2 b$, express the area of the triangle as a monomial.

HINTS and NOTES

ADD/SUBTRACT
You can only add and subtract like terms

Examples of like terms:
$2x, 3x$

$4x^2, -2x^2, \frac{1}{2}x^2$

$2xy, -4xy$

Examples of terms that are not alike:
x^2, x

$3xy, 3y$

$4, 2x$

MULTIPLICATION
- FOIL (first-outside-inner-last)

$(a + b)(c + d)$

- Distributive Property
  $a(b + c) = ab + bc$
- Vertical Format or "stacking"

$$x^2 - 3x + 2$$
$$\underline{\qquad 4x - 1}$$

$$-x^2 + 3x - 2$$
$$\underline{+ 4x^3 - 12x^2 + 8x}$$

$$4x^3 - 13x^2 + 11x - 2$$

- Box Method
  $(2x + 3)(2x - 4y + 10)$

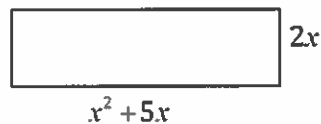|	**2x**	**3**
2x	$4x^2$	$6x$
-4y	$-8xy$	$-12y$
10	$20x$	30

$$4x^2 - 8xy + 14x - 12y + 10$$

PRACTICE A.2b

1. **Which polynomial represents the area of the rectangle?**

   A $x^2 + 7x$
   B $2x^3 + 10x^2$
   C $2x^2 + 10x$
   D $2x^2 + 14x$

   [rectangle with $2x$ on right side and $x^2 + 5x$ below]

2. **The 1990 investments by a corporation are represented by the polynomial $x^2 + 5x - 8$ and the 1997 investments are represented by $x^2 - x + 3$ Which polynomial below represents the total investments for the two years?**

   A $x^2 + 4x - 5$
   B $2x^2 - 4x + 5$
   C $2x^2 + 4x - 5$
   D $2x^2 - 6x - 11$

3. **Find the product of . $(2x + 1)(3x + 4)$**

   A $6x^2 + 4$
   B $6x^2 + 11x + 4$
   C $6x^2 - 11x + 4$
   D $6x^2 - 4$

4. **The length of a side of a square is $4x - 3$. Find the area of the square in terms of x.**

   A $16x^2 + 24x + 9$
   B $16x^2 - 12x + 9$
   C $16x^2 + 9$
   D $16x^2 - 24x + 9$

DIVISION

- You must divide the monomial into each and every term.

$$\frac{4x^2 + 8x + 2}{2x} \to \frac{4x^2}{2x} + \frac{8x}{2x} + \frac{2}{2x} \to$$

$$2x + 4 + \frac{1}{x}$$

- When long dividing, REMEMBER the "Family Method"
  Dad - **Divide**
  Mom - **Multiply**
  Sister - **Subtract**
  Brother – **Bring Down**
  Rover - **Repeat**

Use the formula sheet provided to you for formulas for finding area and perimeter.

5. Find the quotient of $(d + 1)$ and $(d^2 + 4d + 3)$.

   A $d + 5 + \dfrac{8}{d+1}$

   B $d + 3$

   C $d + 5 - \dfrac{2}{d+1}$

   D $d + 3 + \dfrac{8}{d+1}$

6. Simplify $\dfrac{15y^3 + 6y^2 + 3y}{3y}$

   A $5y^2 + 2y + 1$

   B $5y^3 + 2y^2 + 1y$

   C $12y^2 + 3y$
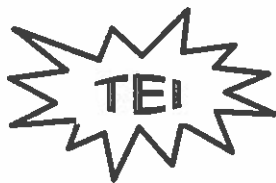
   D $12y^2 + 3y + 1$

7. What is the difference between $k^3 - 2k^2 + 4k + 6$ and $-4k + k^2 - 3$

   A $k^3 - 6k^2 + 3k + 9$

   B $k^3 - 3k^2 + 4k + 9$

   C $k^3 - k^2 + 3$

   D $k^3 - 3k^2 + 8k + 9$

Put your answer in the box. These are open-ended questions. Work them out write your answer in the box (on the computer you would type your answer in the box being sure to put it in appropriate form, simplest fraction, decimal, etc.) For our purposes, you will write your answer in the box.

8. The area of a rectangle is $x^3 + 8x^2 + 13x - 12$ square units. The width of the rectangle is $x + 4$ units. What is the length of the rectangle?

Click and Drag. These questions give you the choices for your answer or answers. You must click on each correct answer and drag it to the appropriate box. You must get all of them correct to get the answer correct. For our purposes, just write the correct answers in the boxes.

9. Click and drag two of the trinomials whose sum is $2x - 5$.

$$-2x^2 + 3x + 5$$

$$x^2 + 5x - 8$$

$$2x^2 + 3x - 5$$

$$-x^2 - 3x + 3$$

HINTS and NOTES

Ways to Factor
- Greatest Common Factor
  $$xy + xz = x(y + z)$$
- Difference of Two Squares
  $$a^2 - b^2 = (a - b)(a + b)$$
- Trinomials
  Circle-Slide-Multiply (or)
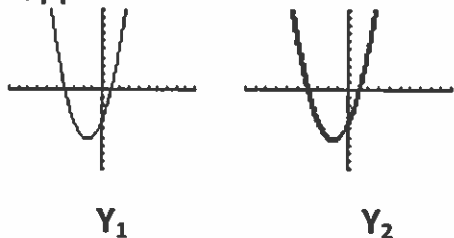 Factor by Grouping (or)
  Guess and check

TI-83 CALCULATOR HELP

1. GO to Y=
2. Type trinomial into Y1
3. Type factoring into Y2
4. Make the line in Y2 darker and wider by using the left arrow to the left of Y2 and pressing Enter once.
5. Graph

If both graphs trace over each other, then the factoring is correct.

```
Plot1  Plot2  Plot3
\Y1=X²+3X-4
\Y2=(X+4)(X-1)
\Y3=■
\Y4=
\Y5=
\Y6=
\Y7=
```

Y_1 Y_2

**This picture of the 2 graphs would show as one coordinate plane. You would see Y_1 graph and then Y_2 would graph on top of Y_1

PRACTICE A.2c

1. Factor
$$3y^2 + 7y - 20$$

A $(3y - 5)(y + 4)$

B $(3y - 20)(y + 10)$

C $(3y - 4)(y + 5)$

D $(3y - 5)(y + 5)$

2. Factor
$$x^2 - 25$$

A $(x + 5)(x - 5)$
B $(x - 5)(x - 5)$
C $(x + 5)(x + 5)$
D $(x + 25)(x - 1)$

3. The area of a rectangle is represented by
$$2x^2 + 5x - 12$$
Which of the following could represent the length of one side of the rectangle?

A $2x + 3$
B $2x - 3$
C $x - 4$
D $x + 12$

4. Which trinomial is represented by algeblocks?

$\square = x^2$

$\square = 1$

$\blacksquare = x$

A $(4x + 3)(x + 1)$
B $(3x + 4)(x + 1)$
C $(x + 4)(x + 1)$
D $(2x + 4)(3x + 4)$

5. A rectangle has an area of A and a width of x. Its perimeter is 14. Which equation must be true?

A $\quad A = 7x - x^2$
B $\quad A = 7x - 2x^2$
C $\quad A = 14x - x^2$
D $\quad A = 14x - 2x^2$

6. Factor
$$2x^2 - 7x - 4$$

A $\quad (2x - 1)(x + 4)$
B $\quad (2x + 4)(x - 1)$
C $\quad (2x + 1)(x - 4)$
D $\quad (2x - 1)(x - 4)$

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Highlight each correct answer. These questions give you choices. You must click on each correct answer and make sure you mark every answer that is correct. If you forget one, it will be incorrect. Circle each correct answer. More than one answer may be selected.

7. In the function, $f(x) = 2x^2 + bx + 12$, identify a value for b so that $f(x)$ can be factored as a product of two binomials.

$b=10$	$b=11$	$b=12$	$b=13$	$b=14$	$b=15$	$b=16$	$b=17$
$b=18$	$b=19$	$b=20$	$b=21$	$b=22$	$b=23$	$b=24$	$b=25$

A.2 SKILLS CHECKLIST: *I can...*

☐ Simplify monomial expressions with integer exponents.
☐ MODEL sums, differences, products, and quotients of polynomials with concrete objects and their related pictorial representations.
☐ Relate concrete and pictorial manipulations that model polynomial operations to their corresponding symbolic representations.
☐ Find sums and differences of polynomials.
☐ Find products of polynomials. The factors will have no more than five total terms
$$\left(i.e.(x+1)(2x^2 + x + 3)\right)$$

☐ Find the quotient of polynomials, using a monomial or binomial divisor, or completely factored divisor.
☐ Factor completely first- and second-degree polynomials with integral coefficients.
☐ Identify prime polynomials.
☐ Use the x-intercepts from the graphical representations of the polynomial to determine and confirm its factors.

SOL A.3
The student will express the square roots and cube roots of whole numbers and the square root of a monomial algebraic expression in simplest radical form.

HINTS and NOTES
Perfect Squares-are numbers whose square root is a whole number.
Non-perfect square roots are irrational and can be simplified or estimated.
Composite Number – a number which has more than 2 factors
Prime Number – a number which only has 2 factors (1 and itself)

To Simplify a Square Root
- Look for perfect square factors
  Ex. $\sqrt{125} = 25 \cdot 5$
Take the square root of 25 and leave the 5.   ANSWER: $5\sqrt{5}$

- Completely Factor and look for Pairs
  Ex. $\sqrt{125} = 5 \cdot 5 \cdot 5$
Take the square root of the pair of 5's and leave the other 5.
ANSWER: $5\sqrt{5}$

Ex. $\sqrt{m^4 y^3} = m \cdot m \cdot m \cdot m \cdot y \cdot y \cdot y = m^2 y \sqrt{y}$

Perfect Cube- is a number that can be written as the cube of another number
$2^3 = 8, 3^3 = 27, 4^3 = 64$
To simplify a Cube Root
- Look for perfect cube factors
Ex. $\sqrt[3]{81} = 27 \cdot 3 = 3\sqrt[3]{3}$
- Completely factor and look for triples
  Ex. $\sqrt[3]{81} = 3 \cdot 3 \cdot 3 \cdot 3 = 3\sqrt[3]{3}$

PRACTICE A.3

1.   What is the simplest radical form of $\sqrt{50}$?

 A $2\sqrt{5}$

 B $2\sqrt{25}$

 C   25

 D $5\sqrt{2}$

2.   Express $\sqrt{28m^4 x^3}$ in simplest radical form.

 A $2\sqrt{7m^4 x^3}$

 B $2m^2 x\sqrt{7x}$

 C $14m^2 \sqrt{x^3}$

 D $14m^2 x^2 \sqrt{x}$

3. Write $\sqrt[3]{135}$ in simplest radical form.

 A $3\sqrt[3]{5}$

 B $3\sqrt[3]{15}$

 C   15

 D   45

4. Simplify the expression

$$\sqrt[3]{-135}$$

 A $3\sqrt[3]{-5}$

 B $-3\sqrt[3]{5}$

 C $-5\sqrt[3]{3}$

 D $5\sqrt[3]{-3}$

Remember: You should treat radicals like variables…
- You can only add or subtract like radicals
- You can multiply and divide anything
- Never leave a negative number under the radical
- Never leave a radical in the denominator
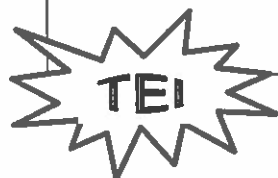
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5. **Simplify the expression**

$$\sqrt{40}-\sqrt{10}+\sqrt{90}$$

A $2\sqrt{30}$

B $\sqrt{120}$

C $4\sqrt{10}$

D $\sqrt{40}-\sqrt{10}+\sqrt{90}$

Put your answer in the box. These are open-ended questions. Work them out write your answer in the box (on the computer you would type your answer in the box being sure to put it in appropriate form, simplest fraction, decimal, etc.) For our purposes, you will write your answer in the box.

6. **Type in the second radical expression which, when multiplied with the given radical expression on the left, will yield the following simplified expression.**

$$2a^2b\sqrt{3ab}$$

$\sqrt{2a^3b^2}$	
$\sqrt{3a^3b^2}$	
$\sqrt{4a^4b}$	
$\sqrt{a^2b^3}$	
$\sqrt{6a^3b}$	
$\sqrt{12b^2}$	

7. **Choose a composite number. Simplify the square root and cube root of your number.**

Composite number   Square Root   Cube Root

A.3 SKILLS CHECKLIST: *I can…*
- ☐ Express square roots of a whole number in simplest form.
- ☐ Express the cube root of a whole number in simplest form.
- ☐ Express the principal square root of a monomial algebraic expression in simplest form where variables are assumed to have positive values.

SOL A.4a,b The student will solve multi-step linear and quadratic equations in two variables, including
a) solving literal equations (formulas) for a given replacement variable.
b) justifying steps used in simplifying expressions and solving equations, using field properties and axioms of equality that are valid for the set of real numbers and its subsets.

<u>**HINTS and NOTES**</u>
Literal Equations
-Just undo what has been done
-The variable stands alone
Properties:
- *Associative Property*
  $(+)\ a + (b + c) = (a + b) + c$
  $(\times)\ a(bc) = (ab)c$
- *Commutative Property*
  $(+)\ a + b + c = b + a + c$
  $(\times)\ abc = cba$
- *Distributive Property*
  $a(b + c) = ab + ac$
- *Identity Property*
  $(+)\ a + 0 = a$
  $(\times)\ a(1) = a$
- *Inverse Property*
  $(+)\ a + (-a) = 0$
  $(\times)\ a \cdot \frac{1}{a} = 1$
- *Reflexive Property*
  $a = a$
- *Symmetric Property*
  $If\ a = b\ then\ b = a$
- *Transitive Property*
  $If\ a = b\ and\ b = c\ then\ a = c$
- *Addition Property of Equality*
  Adding the same term to both   sides of the equation
- *Subtraction Property of Equality*
  Subtracting the same term from both sides of the equation
- *Multiplication Property of Equality*
  Multiplying the same factor to both sides of the equation
- *Division Property of Equality*
  Dividing the same divisor on both sides of the equation

<u>**PRACTICE 4 a, b**</u>
1. **To find the volume of a pyramid you use the formula** $V = \frac{1}{3}Bh$. **Which equation solves this formula for B?**

   A $B = \dfrac{3V}{h}$

   B $B = 3V - h$

   C $B = \dfrac{V}{3h}$

   D $B = \dfrac{V - 3}{h}$

2. **Which property of real numbers justifies going from step 3 to step 4?**

(given)	$-3(4x + 2) + 7x = 39$
(step 1)	$-12x - 6 + 7x = 39$
(step 2)	$-5x - 6 = 39$
(step 3)	$-5x = 45$
(step 4)	$x = -9$

   A   Addition Property of Equality
   B   Additive Inverse Property
   C   Distributive Property
   D   Division Property of Equality

3. **Which property justifies the equation**

   $$(3m^2)(m^6) = (3)(m^5 \cdot m^6)$$

   A   Commutative Property of Multiplication
   B   Associative Property of Multiplication
   C   Multiplication Property of Equality
   D   Distributive Property

4. **Which property justifies the statement** $\dfrac{-2}{3} \cdot \dfrac{-3}{2} = 1$ **?**
   A   Multiplication Identity Property
   B   Multiplication Inverse Property
   C   Multiplication Property of Equality
   D   Commutative Property of Multiplication

5. What is the solution for x of $ax - 5 = b$?

A $a(b + 5)$

B $\dfrac{b + 5}{5}$

C $\dfrac{b - 5}{5}$

D $a(b - 5)$

TE!

Put your answer in the box. These are open-ended questions. Work them out write your answer in the box (on the computer you would type your answer in the box being sure to put it in appropriate form, simplest fraction, decimal, etc.) For our purposes, you will write your answer in the box.

6. The airport parking lot charges $2.00 to enter and $3.00 per hour after that. Carmen has N dollars and wants to be able to determine the number of hours she can park. What equation could Carmen use to determine the length of time she can afford to park her car in the parking lot?

7. Solve $Q = 3a + 5ac$ for a.

8. In uniform circular motion (like in a merry-go-round), the speed v of a point on the edge of a spinning disk is $v = \dfrac{2\pi}{t} r$, where r is the radius of the disk and t is the time it takes the point to travel once around the circle. Solve the formula for r.

> [ ]

Click and Drag. These questions give you the choices for your answer or answers. You must click on each correct answer and drag it to the appropriate box. You must get all of them correct to get the answer correct. For our purposes, just write the correct answers in the boxes.

9. Determine the field property or axiom of equality used to justify each step. You may choose from the Properties listed in the 2-column table.

$(x+3) = 4 + 3x$

$7(x+3) = 4 + 3x$

$7x + 21 = 4 + 3x$

$7x + 21 = 3x + 4$

$4x + 21 = 4$

$4x = -17$

$\dfrac{1}{4}(4x1) = \dfrac{1}{4}(-17)$

$x = \dfrac{1}{4}(-17)$

$x = \dfrac{-17}{4}$

Given	Distributive Property
Commutative Property of Addition	Addition Property of Equality
Commutative Property of Multiplication	Subtraction Property of Equality
Associative Property of Addition	Multiplication Property of Equality
Associative Property of Multiplication	Division Property of Equality
Additive Inverse Property	Substitution Property of Equality
Multiplicative Inverse Property	Reflexive Property of Equality
Zero Property of Multiplication	Symmetric Property of Equality
Property of Negative One	Transitive Property of Equalitiy

A.4a-b SKILLS CHECKLIST: *I can…*

☐ Solve a literal equation (formula) for a specified variable.
☐ Simplify expressions and solve equations, using the field properties of the real numbers and properties of equality to justify simplification and solution.

SOL A.4c
The student will solve multistep linear and quadratic equations in two variables, including:
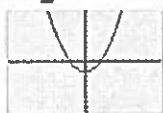**c) solving quadratic equations algebraically and graphically.**

HINTS and NOTES
Quadratic Formula

Standard Form is $ax^2 + bx + c = 0$
- a, b, and c are rational numbers
- if "a" is negative, then the graph will open down
- if "a" is positive, then the graph will open up
- the smaller the absolute value of "a" the wider the graph will be

$$y = \frac{1}{2}x^2 + 0x - 2$$

- the larger the absolute value of "a" the narrower the graph will be

$$y = -2x^2 + 0x + 2$$

Three ways to Solve Quadratic-
- Use the quadratic formula
- Factor, set each factor = 0 and solve for x
- Graph

Function Notation is $f(x)$. It means the same thing as $y =$.

Practice A. 4c

1. **How many solutions will the quadratic equation $5x^2 + 4x + 3 = 0$ have?**

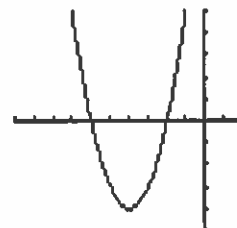   A No solutions   B One solution
   C Two solutions   D Three solutions

2. **Solve $8x = x^2 + 15$**

   A $x = -6$ and $x = 2$
   B $x = 12$ and $x = 1$
   C $x = 4$ and $x = -3$
   D $x = 3$ and $x = 5$

3. **Which of the following best describes the solutions and vertex of the graph?**
   A vertex (-2,0)
        solutions −6 and −2
   B vertex (4, 4)
        solutions 2 and 6
   C vertex (-2,-6)
        solution -4
   D vertex (-4,-4)
        solutions −6 and -2

4. **Jasmine is diving off a 3-meter springboard. Her height in meters above the water when she is x meters horizontally from the end of the board is approximated by the equation $h = -x^2 + 3x + 3$. What is the maximum height Jasmine will reach on her dive?**

   A 1.5 meters
   B 3 meters
   C 5.25 meters
   D 6.1 meters

Once graphed you can find the x-intercepts of the equation by
- 2nd TRACE- zeroes
- Moving cursor to find the left and right bound of each x-intercept
- Guess

Once graphed you can find the vertex
- 2nd TRACE- minimum or maximum
- Move cursor to the left and right of the vertex
- Guess

5. To the nearest hundredth, what are the solutions of the quadratic equation $x^2 - 12x + 28 = 0$?

A $-3.17 \; and \; -8.83$

B $3.17 \; and \; 8.83$

C $4 \; and \; 7$

D $28 \; and \; 0$

6. Using the graph of a quadratic function, determine the 2 factors which could be used to write the quadratic equation.
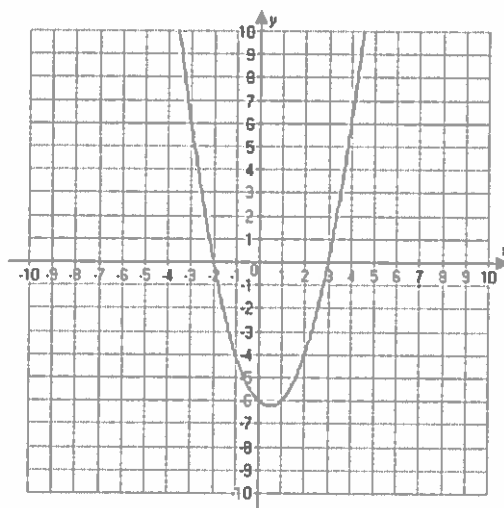
A $f(x) = (x+3)(x-2)$

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

C $f(x) = (x+2)(x+3)$

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

Hot Spot Item – You will be asked to plot points on a coordinate plane. If you don't use the "arrow" key to plot the points, your answer will not be considered answered. "AAA" (Always use the arrow key)   DO NOT USE THE "DOT" KEY. Make sure you plot all points or the problem will be considered incorrect.

7. **Plot the vertex, x-intercepts, and y-intercept of** $f(x) = x^2 - 2x - 8$ **on the coordinate plane.**
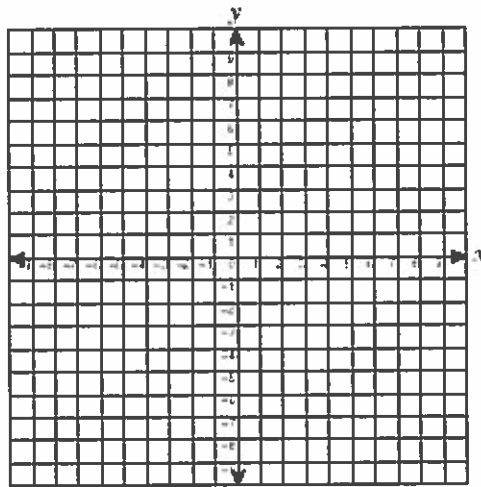
Put your answer in the box. These are open-ended questions. Work them out write your answer in the box (on the computer you would type your answer in the box being sure to put it in appropriate form, simplest fraction, decimal, etc.) For our purposes, you will write your answer in the box.

8. **Solve** $f(x) = x^2 - 2x - 8$. **Type your answer in the box.**

Highlight each correct answer. These questions give you choices. You must click on each correct answer and make sure you mark every answer that is correct. If you forget one, it will be incorrect. Circle each correct answer. More than one answer may be selected.

9. **Highlight each function which has exactly one zero.**

$$f(x)=x^2+3x-10$$

$$f(x)=x^2-5x-20$$

$$f(x)=5(x+3)-9$$

$$f(x)=3$$

$$f(x)=(x-6)^2$$

A.4c SKILLS CHECKLIST: *I can...*
- ☐ Solve quadratic equations
- ☐ Identify the roots or zeros of a quadratic function over the real number system as the solution(s) to the quadratic equation that is formed by setting the given quadratic expression equal to zero.
- ☐ Confirm algebraic solutions to quadratic equations, using a graphing calculator.

SOL A.4d
The student will solve multistep linear and quadratic equations in two variables, including
d) Solving multistep linear equations algebraically and graphically.

HINTS and NOTES

Solving Multistep Equations
- Distribute
- Combine Like Terms
- Move all variables to the left and constants to the right
  (or)
  Move all constants to the left and all variables to the right
- Solve and Check

TI-83 CALCULATOR HELP

Steps to checking a solution to a linear equation using your graphing calculator.
- Put left side of original equation in Y1
- Put right side of original equation in Y2
- 2nd Trace
- 5: Intersect
- Enter- Enter- Enter

PRACTICE A.4d

1. Solve $4(n+1)=2(11-n)$?

   A $n=3$
   B $n=4$
   C $n=7$
   D $n=13$

   What is the solution to $2-\dfrac{3}{4}k=\dfrac{1}{8}k+9$?

   A $k=8$
   B $k=7$
   C $k=-7$
   D $k=-8$

2. What is the solution of $5x-17=x-11$?

   A $-\dfrac{28}{3}$
   B -4
   C $\dfrac{6}{7}$
   D 2

3. What is the solution of $\dfrac{x+3}{4}=\dfrac{2x+6}{3}$?

   A $-\dfrac{5}{3}$ B $-\dfrac{9}{5}$ C $-\dfrac{33}{5}$ D 9

4. Solve $-5x-10=2-(x-4)$.

   A $x=6$
   B $x=\dfrac{-2}{3}$
   C $x=-2$
   D $x=-4$

Put your answer in the box. These are open-ended questions. Work them out write your answer in the box (on the computer you would type your answer in the box being sure to put it in appropriate form, simplest fraction, decimal, etc.) For our purposes, you will write your answer in the box.

5. The formula for the perimeter of a rectangle is $P = 2l + 2w$, where l is the length and w is the width. A rectangle has a perimeter of 24 inches. Find its dimensions if its length is 3 inches greater than its width.

Click and Drag. These questions give you the choices for your answer or answers. You must click on each correct answer and drag it to the appropriate box. You must get all of them correct to get the answer correct. For our purposes, just write the correct answers in the boxes.

6. Click and Drag each of the following equations to its appropriate column indicating that it has one solution, no solution or infinitely many.

One Solution	No Solutions	Infinitely Many Solutions

$10(x+3)+8=18x+30$

$4(6a+3)=6(4a+2)$

$12(c+3)-30=12c+36$

$16n-20=4(5n+1)$

A.4d SKILLS CHECKLIST: *I can...*

☐ Solve multi-linear equations in one variable.
☐ Confirm algebraic solutions to linear equations using a graphing calculator.
☐ Determine if a linear equation in one variable has one, an infinite number, or no solutions.

SOL A.4e,f
The student will solve multistep linear and quadratic equations in two variables, including
e) solving systems of two linear equations in two variables algebraically and graphically
f) solving real-world problems involving equations and systems of equations.

HINTS and NOTES

How to Solve Systems of Equations
- **Graphing- Graph each equation and look for the point of intersection between the two lines.**
  - Parallel lines= No solution
  - Same line= infinitely many solutions
- **Substitution**
  - solve one equation for a variable
  - substitute that expression for that variable into the other equation
  - solve for the remaining variable
  - substitute value of variable into equation and solve for other variable
- **Elimination**
  - create a pair of opposite variables within the set of equations
  - add vertically so that one variable cancels out
  - substitute the value of the variable solved for back into equation so that you can find value of other equation

To check and see if your solution is correct- substitute value of variables into equation and see if your statement is true!

Practice A.4e,f

1. What is the solution of the following system of equations?

$$\begin{cases} 2x + y = 6 \\ 3x - 7y = 9 \end{cases}$$

A $(-3, 12)$
B $(2, 2)$
C $(3, 0)$
D $(1, 4)$

2. The sum of two numbers is 35. Three times the smaller number less the greater numbers is 17. Which system of equations describes the two numbers?

A $\begin{cases} x + y = 35 \\ 3x - y = 17 \end{cases}$

B $\begin{cases} x + y = 35 \\ x - y = 17 \end{cases}$

C $\begin{cases} x + y = 35 \\ x - 3y = 17 \end{cases}$

D $\begin{cases} x + y = 35 \\ x + y = 17 \end{cases}$

3. Joe has a 300 foot fence around his rectangular yard. The length is 10 feet more than the width. Which equation can you use to determine the dimensions?

A $x + (x + 10) = 300$
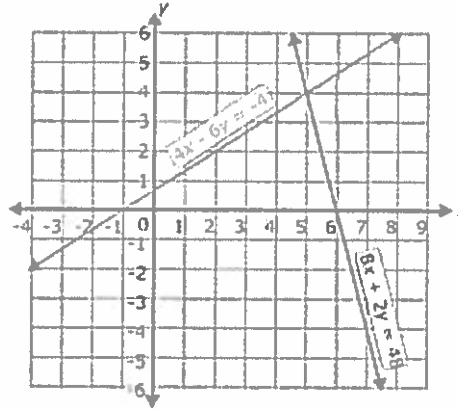B $x(x + 10) = 300$
C $2x + 210x = 300$
D $2x + x(x + 10) = 300$

TI-83 CALCULATOR HELP
Solving Systems of Equations
- **Y1= one equation solved for y**
- **Y2= the second equation solved for y**
- **GRAPH**
- **2nd TRACE**
- **5: Intersect**
- **ENTER-ENTER-ENTER**

4. What is the solution to the system of equations graphed below?

A $(-4,5)$

B $(-5,4)$

C $(5,4)$

D $(4,5)$

5. Which of the following is the solution to the system of equations below?

$$\begin{cases} 3x = 2y + 6 \\ 5x + 7y = 41 \end{cases}$$

A $(4, 1)$

B $(3, 0)$

C $(4, 3)$

D $(4, -3)$

7. Sally would like a 90 average on the five math tests this semester. Her scores so far are 80, 82, 92, 98. What grade must she earn on her 5th and last test to achieve the 90 average?

A 95

B 96

C 98

D 99

TEI

Click and Drag. These questions give you the choices for your answer or answers. You must click on each correct answer and drag it to the appropriate box. You must get all of them correct to get the answer correct. For our purposes, just write the correct answers in the boxes.

8. A library contains 2000 books. There are 3 times as many non-fiction books as fiction books. Click and Drag from the table on the left to the box on the right to make a system of equations to determine the number on non-fiction books and fiction books.

$y = 3x$
$3x + y = 2000$
$3x + 3y = 2000$
$x + y = 2000$

$$\left\{ \right.$$

Highlight each correct answer. These questions give you choices. You must click on each correct answer and make sure you mark every answer that is correct. If you forget one, it will be incorrect. Circle each correct answer. More than one answer may be selected.

9. Tia and Ken each sold snack bars and magazine subscriptions for a school fund-raiser, as shown in the table on the left. Tia earned $132 and Ken earned $190. Highlight the two equations which will make up the system of equations to formulate a system of linear equations from this situation.

Item	Number Sold	
	Tia	Ken
Snack bars	16	20
Magazine subscriptions	4	6

$16s + 20m = \$132$
$16s + 4m = \$132$
$16s + 20m = \$190$
$20s + 6m = \$190$
$4s + 6m = \$132$
$4s + 6m = \$190$

Put your answer in the box. These are open-ended questions. Work them out write your answer in the box (on the computer you would type your answer in the box being sure to put it in appropriate form, simplest fraction, decimal, etc.) For our purposes, you will write your answer in the box.

10. Two times a number plus three times another number equals 4. Three times the first number plus four times the other number is 7. Type the system of equations in the box provided

Click and Drag. These questions give you the choices for your answer or answers. You must click on each correct answer and drag it to the appropriate box. You must get all of them correct to get the answer correct. For our purposes, just write the correct answers in the boxes.

11. Click and Drag each of the following equations to its appropriate column indicating that it has one solution, no solution or infinitely many.

One Solution	No Solutions	Infinitely Many Solutions

$$\begin{cases} 5x + y = 6 \\ 5x + y = -6 \end{cases}$$

$$\begin{cases} 4x - y = 2 \\ y = -4 \end{cases}$$

$$\begin{cases} x + 3y = -3 \\ x - 3y = -3 \end{cases}$$

$$\begin{cases} -2x + y = 5 \\ -4x + 2y = 10 \end{cases}$$

A.4e,f SKILLS CHECKLIST: *I can…*

- ☐ Solve a linear system in two variables by substitution or elimination to find the ordered pair which satisfies both equations.
- ☐ Solve a linear system in two variables graphically by identifying the point of intersection.
- ☐ Determine whether a system of two linear equations has one solution, no solution or infinite solutions.
- ☐ Write a system of two linear equations that models a real-world situation.
- ☐ Interpret and determine the reasonableness of the algebraic or graphical solution of a system of two linear equations that models a real-world situation.

SOL A.5a-c

The student will solve multistep linear inequalities in two variables, including
a) Solving multistep linear inequalities algebraically and graphically;
b) Justifying steps used in solving inequalities, using axioms of inequality and properties of order that are valid for the set of real numbers and its subsets;
c) Solving real-world problems involving inequalities

HINTS and NOTES

Reminder: Inequalities have a solution set and can be written in set builder notation $\{x \,|\, x \leq 32\}$

"For all x such that x is less than or equal to 32."

To solve inequalities:
- Distribute
- Combine Like Terms
- Move all variables to left and constants to the right
- Solve and Check

ERROR ALERT- Switch direction of the comparison sign when $\div / \times$ by negative number during solving.

Shading of Graphs:
> is greater than (open-right)

< is less than (open-left)

$\geq$ is greater than or equal to (closed-right)

$\leq$ is less than or equal to (closed-left)

PRACTICE A.5 a-c

1. Solve
$$-5x + 5 > 25$$

   A $\{x \,|\, x > 5\}$

   B $\{x \,|\, x < -4\}$

   C $\{x \,|\, x > -4\}$

   D $\{x \,|\, x < 25\}$

2. Solve $2x - 18 \geq 5(x + 3)$

   A $\{x \,|\, x \leq -11\}$

   B $\{x \,|\, x \geq -11\}$

   C $\{x \,|\, x \geq 1\}$

   D $\{x \,|\, x \leq 1\}$

3. Joel sells ice cream cones at the county fair. He has to rent the equipment for $36 and spend $0.52 on ingredients for each cone. What is the minimum number of ice cream cones Joel must sell at $1.40 each in order to make a profit?

   A   39
   B   40
   C   41
   D   42

Set Notation is often used to show answers to inequalities because your answer is not a number, but a set of numbers. It looks like this:

$$\left\{ x \middle| x \ge \frac{3}{4} \right\}$$

It is read "x such that x is greater than or equal to three-fourths". It means the same thing as $x \ge \dfrac{3}{4}$

4. **Solve and graph**
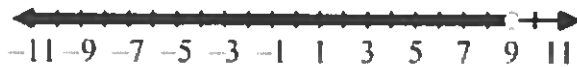
$$-8(3d - 2) \ge -200$$

A $\{d | d \ge 9\}$

B $\{d | d \le 9\}$

C $\{d | d \ge 9\}$
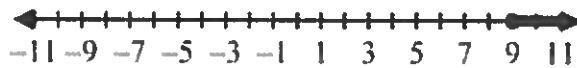
D $\{d | d < 9\}$

Click and Drag. These questions give you the choices for your answer or answers. You must click on each correct answer and drag it to the appropriate box. You must get all of them correct to get the answer correct. For our purposes, just write the correct answers in the boxes.

10. The following inequality has been solved. In each step, provide the property that justifies each step by clicking and dragging the property to each step.

Given	Distributive Property	Associative Property of Addition	Multiplicative Inverse Property
Commutative Property of Addition	Addition Property of Inequality	Associative Property of Multiplication	Zero Property of Multiplication
Commutative Property of Multiplication	Subtraction Property of Inequality	Additive Inverse Property	Property of Negative One
Multiplication Property of Inequality	Division Property of Inequality	Substitution Property of Inequality	Reflexive Property of Inequality
Reflexive Property of Inequality	Symmetric Property of Inequality	Transitive Property of Inequality	

$-3(-2x-7)+3 \leq 10(2x-2)-12$

$6x+21+3 \leq 20x-20-12$

$6x+24 \leq 20x-32$

$-14x+24 \leq -32$

$-14x \leq -56$

$\dfrac{-14x}{-14} \leq \dfrac{-56}{-14}$

$x \geq 4$

Highlight each correct answer. These questions give you choices. You must click on each correct answer and make sure you mark every answer that is correct. If you forget one, it will be incorrect. Circle each correct answer. More than one answer may be selected.

11. Look at each student's work. Highlight the incorrect step in each inequality.

Ray's Solution	Sam's Solution	Joe's Solution	Pat's Solution	Tom's Solution
$3-7x \geq -6$	$3-7x \geq -6$	$3-7x \geq -6$	$3-7x \geq -6$	$3-7x \geq -6$
$-7x \geq -9$	$7x-3 \geq 6$	$-7x \geq -3$	$9-7x \geq 0$	$3 \geq 7x+6$
$7x \leq 9$	$7x \geq 9$	$x \geq \dfrac{-3}{7}$	$9 \geq 7x$	$-3 \geq 7x$
$x \geq \dfrac{9}{7}$	$x \leq \dfrac{9}{7}$		$\dfrac{9}{7} \geq x$	$\dfrac{-3}{7} \geq x$
			$x \geq \dfrac{9}{7}$	$x \leq \dfrac{-3}{7}$

A.5a-c SKILLS CHECKLIST: *I can...*

- ☐ Solve multistep linear equations in one variable.
- ☐ Justify steps used in solving inequalities, using axioms of inequality and properties of order that are valid for the set of real numbers.
- ☐ Solve real-world problems involving inequalities.
- ☐ Solve systems of linear inequalities algebraically and graphically.

SOL A.5d

**The student will solve multistep linear inequalities in two variables, including
d) solving systems of inequalities**

HINTS and NOTES

Solving System of Linear Inequalities:
- Graph both linear inequalities on same coordinate grid
  - Easier if put in $y = mx + b$
  - Shade the "true side" of both lines
  - Line is solid if $\leq or \geq$
  - Line is dotted if $< or >$
- Reminder the solution includes the entire region that is shared by both inequalities.

TI-83 HELP
- Put one inequality in for Y_1
- Put the second inequality in for Y2
- Use arrow keys to move to the left of Y1 and push the enter button to select ◤ (<) or ◥ (>) shading
- Use arrow keys to move to the left of Y_2 and push the enter button to select ◤ (<) or ◥ (>) shading
- Press GRAPH and identify the shared area. You will have to interpret if the lines should be dotted or solid.
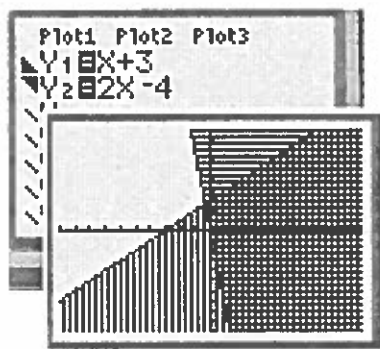
1. A salesman at a new car dealership gets paid a fixed commission above his base salary for any passenger car he sells and a different fixed commission for any sport utility vehicle he sells. In August, he sold 5 passenger cars and 5 sport utility vehicles and earned more than $2500 above his base salary. In September, he sold 8 passenger cars and 3 sport utility vehicles and earned less than $3000 above his base salary. This information can be represented by the following inequalities and their graph, where p represents the number of passenger cars sold and s represents the number of sport utility vehicles sold.

$$\begin{cases} 5p+5s>2500 \\ 8p+3s<3000 \end{cases}$$
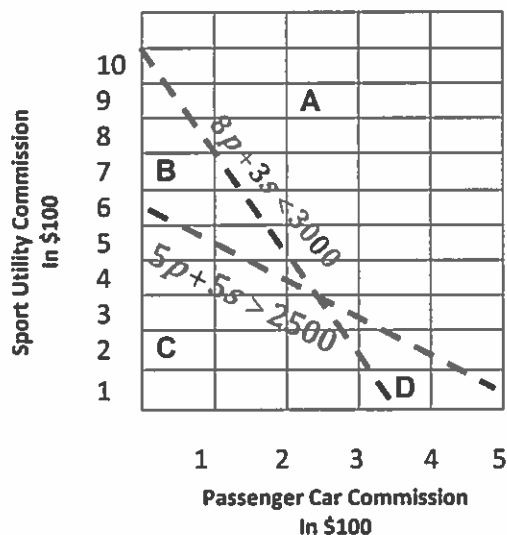
Which region of the graph represents the possible commissions paid to the salesman for the two types of vehicles?

A   Region A
B   Region B
C   Region C
D   Region D

Highlight each correct answer. These questions give you choices. You must click on each correct answer and make sure you mark every answer that is correct. If you forget one, it will be incorrect. Circle each correct answer. More than one answer may be selected.

2. **Using the given graph and the points listed below the graph, highlight all the points which are solutions of**
$$\begin{cases} y \geq 2x - 3 \\ y \leq -1.25x + 2.5 \end{cases}$$
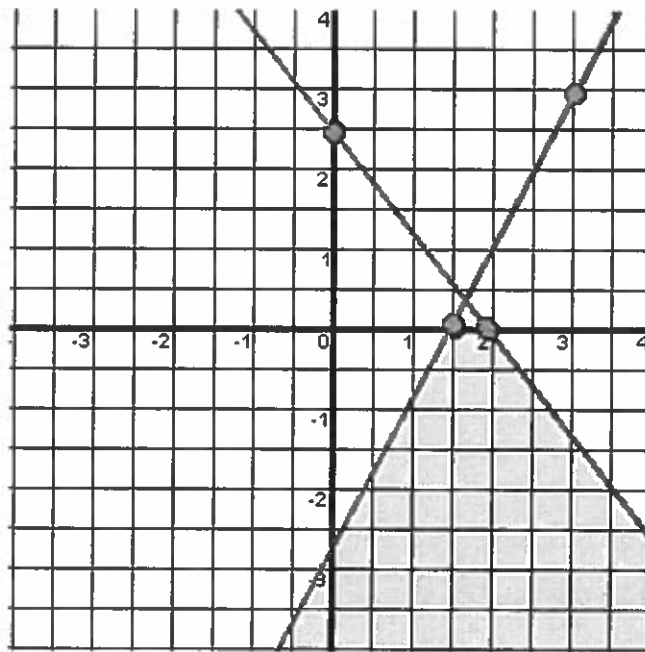
(-3, -2)	(1, -3)	(2, -2)	(.5, 2)	(1, -1)	(2, .5)	(3, 1.5)

Click and Drag. These questions give you the choices for your answer or answers. You must click on each correct answer and drag it to the appropriate box. You must get all of them correct to get the answer correct. For our purposes, just write the correct answers in the boxes.

3. Match each graph to its system of Inequalities by clicking and dragging the system to the graph.
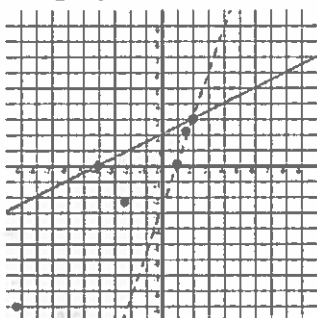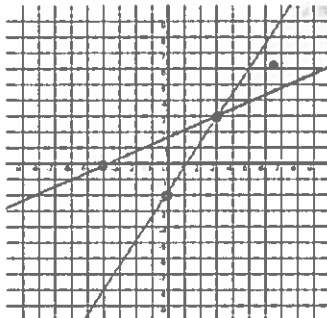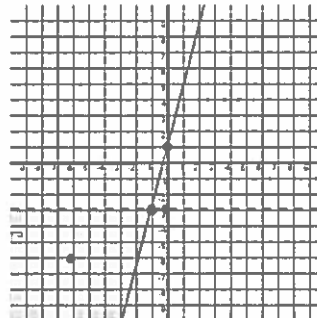
$$\begin{cases} y < -3 \\ y \geq 4x+1 \end{cases}$$

$$\begin{cases} y \leq \dfrac{1}{2}x+2 \\ y > 3x-3 \end{cases}$$

$$\begin{cases} y \geq \dfrac{5}{2}x-2 \\ y \geq \dfrac{1}{2}x+2 \end{cases}$$

Put your answer in the box. These are open-ended questions. Work them out write your answer in the box (on the computer you would type your answer in the box being sure to put it in appropriate form, simplest fraction, decimal, etc.) For our purposes, you will write your answer in the box.

4. Write the System of Inequalities for the given graph.
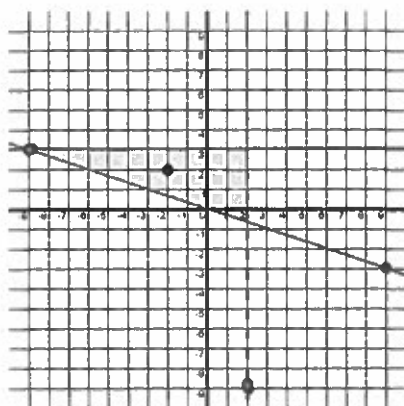
A.5d SKILLS CHECKLIST: *I can…*

☐ Solve systems of linear inequalities algebraically and graphically.

SOL A.6
The student will graph linear equations and linear inequalities in two variables, including
a) Determining the slope of a line when given an equation of the line, the graph of the line, or two points on the line. Slope will be described as rate of change and will be positive, negative, zero, or undefined; and
b) writing the equation of a line when given the graph of the line, two points on the line, or the slope and a point on the line.

HINTS and NOTES

Methods Used to Find Slope
- Graphing
$$\frac{rise}{run} \ or \ \frac{difference\ in\ range}{difference\ of\ domain}$$
- Formula with 2 ordered pairs
$$(x_1, y_1)(x_2, y_2)$$
$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
- From an equation of a line

Slope Intercept
$$y = mx + b$$

Slope	y-intercept
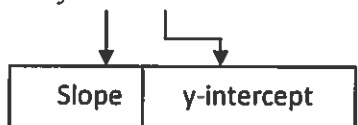
Standard Form
$$Ax + By = C$$
$$m = \frac{-A}{B}$$

Slopes are classified as

- Positive $y = (+)mx + b$

- Negative $y = (-)mx + b$

- Zero $y = \#$

- Undefined or no slope $x = \#$

PRACTICE A.6 a
1. Find the slope of PQ if P(1,1) and Q(5,4).

A $\dfrac{4}{3}$

B $\dfrac{3}{4}$

C $-\dfrac{4}{3}$

D $-\dfrac{3}{4}$

2. Find the slope of the line shown
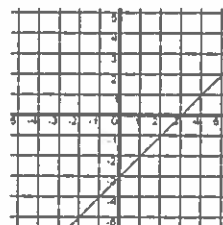
A 0
B undefined
C 1
D -1

3. Find the slope of $8x + 2y = -10$

A -10
B -8
C -4
D 4

4. Find the slope of $y = 4$.

A 0
B 4
C undefined
D 1

You can graph an equation by:
- Using a table of values
- Using the x and y intercepts
- Using slope-intercept form
  $y = mx + b$

You can find the intercepts by:
- Substituting 0 for y to find the $x - intercept$
- Substituting 0 for x to find the $y - intercept$

"VUX HOY"
- <u>V</u>ertical lines have an <u>U</u>ndefined slope and come in the form <u>x</u> = #
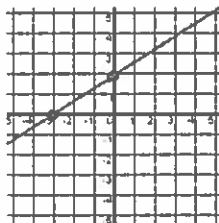- <u>H</u>orizontal lines have a slope of zero (<u>0</u>) and come in the form <u>y</u>=#

TI-83 CALCULATOR HELP
- Type in the equation at Y=
- Look at Table (2nd GRAPH) for solution pairs

5. If the line $y = x + 2$ moved to $y = x + 4$, then how did it move?

    A moves right 2 units
    B moves right 4 units
    C moves up 2 units
    D moves down 2 units

6. Which graph represents $2x - 3y = -7$?

    A   B
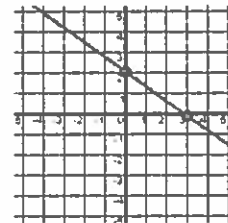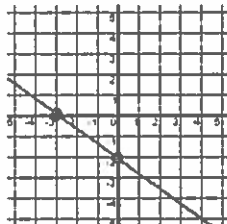
    C   D
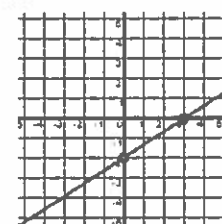
7. What are the x- and y-intercepts of $2x - 4y = 7$?

    A   3.5 and -7

    B   -1.75 and 3.5

    C   -3.5 and 1.75

    D $\frac{2}{7}$ and $\frac{4}{7}$

8. Which coordinate pair is a solution of $y = 2x + 4$?

    A   (-2, 0)

    B   (0, 6)

    C   (2, -6)

    D   (1, 1)

Writing Equations of Lines
Given Slope and y-Intercept

- **Use** $y = mx + b$ where
  $m = slope$
  $b = y - intercept$

Given Two-Points on a Line
- **One Way**
  1) find slope

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

  2) substitute slope (m) and values of point (x, y) into $y = mx + b$ and solve for b

  3) substitute m and b into
     $y = mx + b$

- **Another Way**
  $$y - y_1 = m(x - x_1)$$

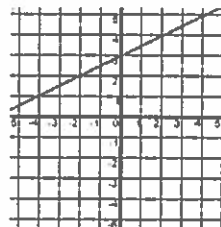 1) substitute x_1 & y_1 with point
  2) substitute m with slope

Given Slope and one-point on the line
- **Use the same steps as if you were given Two Points on a line**

9. **Which is the equation of the line through the point (-4, 2) and having a slope of 1?**

   A $y = x + 6$

   B $y = x + 2$

   C $y = x - 6$

   D $y = x - 2$

10. **Which of the following equations best represents the line graphed?**

   A $y = 2x + 3$

   B $y = -2x + 3$

   C $y = \frac{1}{2}x + 3$

   D $y = -\frac{1}{2}x + 3$

11. **Which is the equation of the line with slope $\frac{-1}{2}$ and y-intercept of -4?**

   A $x - 2y = 8$

   B $2x + y = -8$

   C $-4x + \frac{1}{2}y = 1$

   D $x + 2y = -8$

When graphing linear inequalities, remember
- you have to shade the "true side" of the line.
- The line is solid if the inequality is $\leq$ or $\geq$
- The line is dashed if the inequality is $<$ or $>$

TI-83 CALCULATOR HELP
- Put one inequality in for Y_1
- Put the second inequality in for Y_2
- Use arrow keys to move to the left of Y_1 and push the enter button to select ◣ ($<$) or ◤ ($>$) shading
- Use arrow keys to move to the left of Y_2 and push the enter button to select ◣ ($<$) or ◤ ($>$) shading
- Press GRAPH and identify the shared area. You will have to interpret if the lines should be dotted or solid.

12. Which is the equation of the line through the points (-2, 2) and (5, 9) ?

A $\quad y=x+4$

B $\quad y=x+2$

C $\quad y=x-4$

D $\quad y=x-2$

13. Which of the following equations represents a line through the points (-6, 8) and (2, 8) ?

A $\quad x=-6$

B $\quad y=2$

C $\quad x=8$

D $\quad y=8$

14. Which inequality is shown
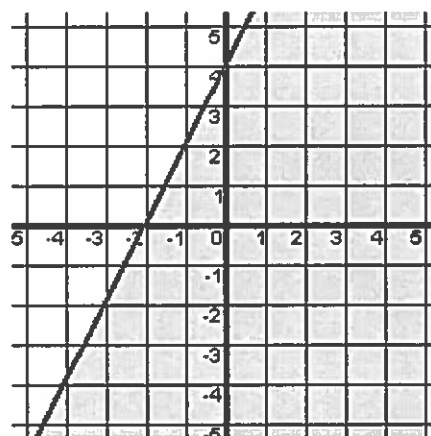
A $\quad y>2x+4$

B $\quad y\geq 2x+4$

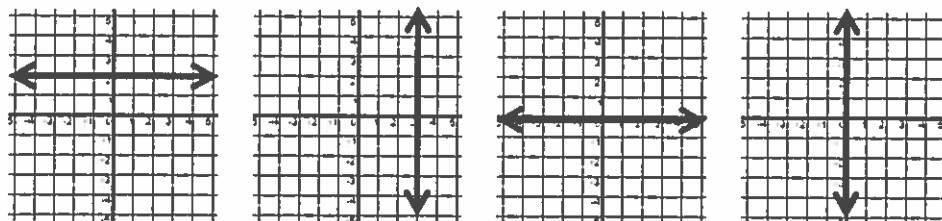C $\quad y<2x+4$

D $\quad y\leq 2x+4$

Highlight each correct answer. These questions give you choices. You must click on each correct answer and make sure you mark every answer that is correct. If you forget one, it will be incorrect. Circle each correct answer. More than one answer may be selected.

15. Highlight the graphs which have a slope of undefined.

Put your answer in the box. These are open-ended questions. Work them out write your answer in the box (on the computer you would type your answer in the box being sure to put it in appropriate form, simplest fraction, decimal, etc.) For our purposes, you will write your answer in the box.

16. Write the equation of each of the graphs. Be sure to use function notation.
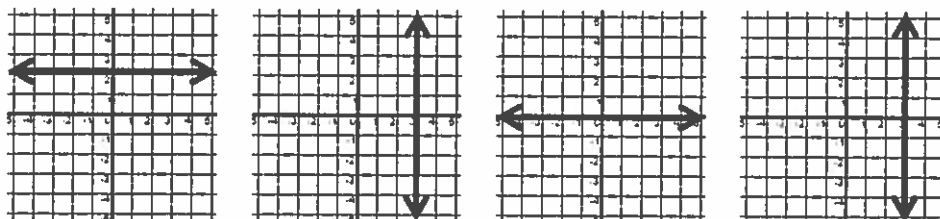
Hot Spot Item – You will be asked to plot points on a coordinate plane. If you don't use the "arrow" key to plot the points, your answer will not be considered answered. "AAA" (Always use the arrow key)   DO NOT USE THE "DOT" KEY. Make sure you plot all points or the problem will be considered incorrect.

17. Plot 2 points found on the line of this function $f(x)=\dfrac{-2}{3}x+4$ on the coordinate plane.

Then draw a line through those points. Be sure to extend your line through all possible quadrants.
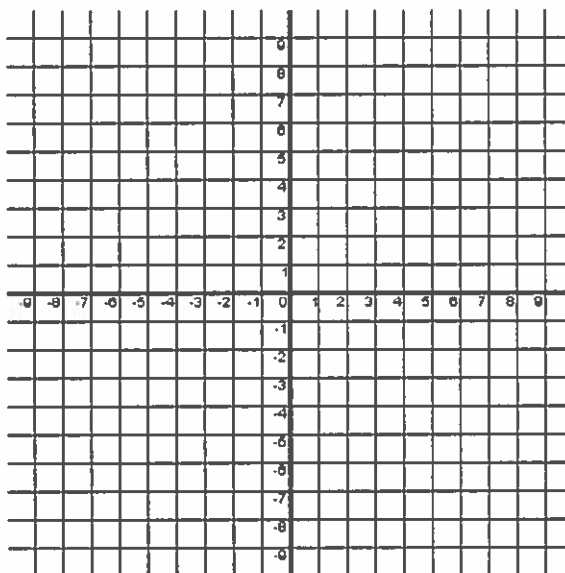
18. Graph the inequality $y\le\dfrac{-3}{4}x-2$ on the coordinate plane. Be sure to extend your line through all possible quadrants.
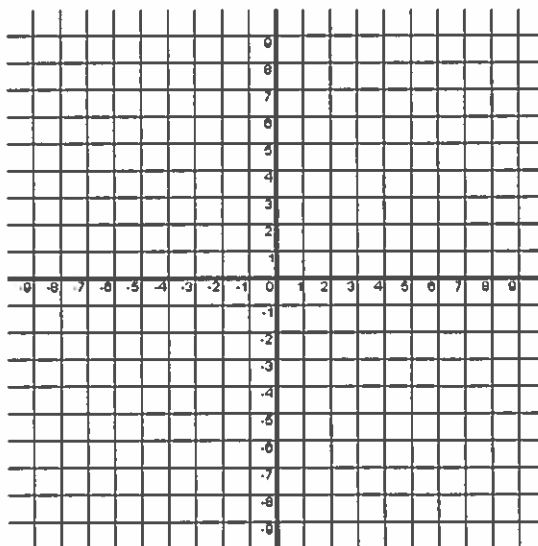
Highlight each correct answer. These questions give you choices. You must click on each correct answer and make sure you mark every answer that is correct. If you forget one, it will be incorrect. Circle each correct answer. More than one answer may be selected.

19. **Highlight the points which would be included in the solution set of** $y < \dfrac{-3}{4}x - 2$.

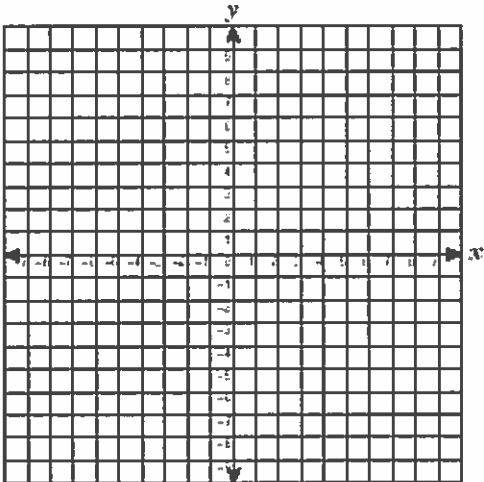| $(-2,0)$	$(-8,1)$	$(-1,-2)$	$(8,3)$	$(-3,-1)$	$(3,-5)$	$(-9,4)$	$(-4,4)$
$(-4,1)$	$(-3,0)$	$(-9,9)$	$(0,-3)$	$(4,-2)$	$(-5,2)$	$(-5,4)$	$(-8,4)$

A.6 SKILLS CHECKLIST: *I can...*

☐ Graph linear equations and inequalities in two variables, including those that arise from a variety of real-world situations.

☐ Use the parent function $y = x$ and describe transformations defined by changes in the slope of y-intercept.

☐ Find the slope of the line, given the equation of a linear function.

☐ Find the slope of a line, given the coordinates of two points on the line.

☐ Find the slope of a line, given the graph of a line.

☐ Recognize and describe a line with a slope that is positive, negative, zero, or undefined.

☐ Use transformational graphing to investigate effects of changes in equation parameters on the graph of the equation.

☐ Write an equation of a line when given the graph of a line.

☐ Write an equation of a line when given two points on the line whose coordinates are integers.

☐ Write an equation of a line when given the slope and a point on the line whose coordinates are integers.

☐ Write an equation of a vertical line $X = a$

☐ Write an equation of a horizontal line as $y = c$.

Answer Sheet for Equations and Inequalities

A.4 ab
1
2
3
4
5
6
7
8
9

A.4 d
1
2
3
4
5
6
7

A.4c
1
2
3
4
5
6
7

8
9

A.4 e, f
1
2
3
4
5
6
7
8
9
10
11
12
One Solution
No Solutions
Infinite Solutions

SOL A.7

The student will investigate and analyze function (linear and quadratic) families and their characteristics both algebraically and graphically, including a) determining whether a relation is a function; b) domain and range; c) zeros of a function; d)   x- and y-intercepts; e) finding the values of a function for elements in its domain; and f) making connections between and among multiple representations of functions including concrete, verbal, numeric, graphic, and algebraic.

HINTS and NOTES

Relation- can be functions or NOT functions
- Mapping
- Set of ordered pairs
- Table of Values
- Graph

Function- is a relation that has an output that is unique to an input
Domain- x-values or input
Range- y-values or output

Function	Not Function (Relation only)
Domain can't repeat	Domain can repeat
Must pass vertical line test	Fails vertical line test

PRACTICE A.7

1. Which relation below is not a function?

   A $\{(2,8)(3,-10)(-1,1)(0,-1)\}$

   B $\{(-3,8)(4,-6)(-2,6)(-9,8)\}$

   C $\{(1,9)(5,-8)(-1,3)(-2,4)\}$

   D $\{(1,6)(8,-3)(-1,-6)(8,2)\}$
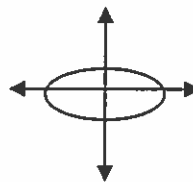
2. What is the range of the function of
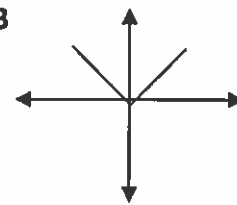 $f(x) = -x^2 - 3$ when the domain is $\{-4,-1,5\}$?

   A $\{13,-2,22\}$

   B $\{19,4,28\}$

   C $\{13,-4,-28\}$

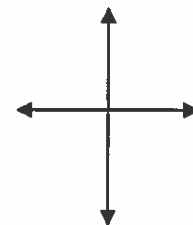   D $\{-19,-4,-28\}$

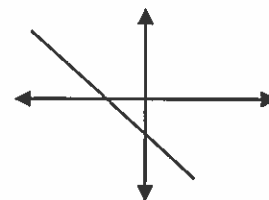3. Which of the following is not a function?

   A   B

   C   D

$f(x)$ means the "function evaluated at x"

When you evaluate a function you are to substitute that value in place of x to find $f(x)$
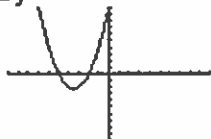
$f(x)$ is the same thing as "y"

The zeroes of the function are the x-intercepts of the function.

A quadratic function can have:
- One zero (sits on or hangs from the x-axis)
- Two zeros (crosses the x-axis twice)
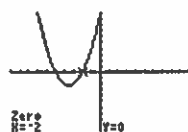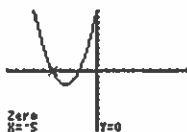- No zeros (never crosses the x-axis)

TI-83 CALCULATOR HELP

Put function in Y1, once graphed you can find the x-intercepts of the equation by

- 2nd trace-zeros

```
CALCULATE
1:value
2:zero
3:minimum
4:maximum
5:intersect
6:dy/dx
7:∫f(x)dx
```

- Move cursor to find the left and right bound of each x-intercept
- Guess

Zero X=-5 Y=0   Zero X=-2 Y=0

---

4. Which table is a function?

A

x	-1	3	-1	-8
y	3	-2	-2	17

B

x	-2	4	-1	-7
y	3	3	-1	1

C

x	-8	1	0	-8
y	2	2	-3	1

D

x	-2	1	-9	1
y	4	3	-2	4

5. What is the zero of the function $f(x) = 2x + 6$?

  A -3

  B 0

  C 3

  D 6

6. If $f(x) = x^2 + 2x + 4$, then what is $f(3)$?

  A 19

  B 16

  C $\dfrac{19}{3}$

  D $\dfrac{16}{3}$

7. Which a the zero of the following function
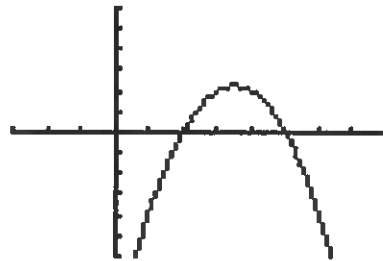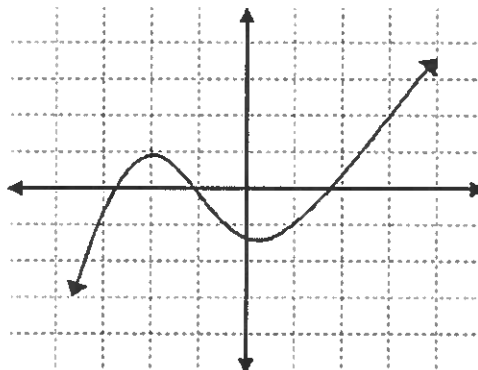$$f(x) = x^2 + 3x - 18$$

  A 1

  B 2

  C 3
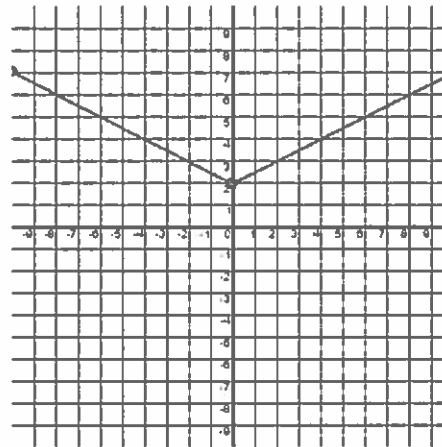
  D 4

8. What are the zeroes of the graphed function?

A 2 and 5
B 3 and 2
C 0 and 2
D 0 and 5

9. What is the range of the following function?

A $\{y|-1.5<y<-1\}$
B $\{y|y=\mathbb{R}\}$
C $\{y|-3.75<y<2.75\}$
D $\{y|-3<y<3.25\}$

10. What is the domain of the following function?

A $\{y|-3<y<3.25\}$

B $\{y|-3<y<3.25\}$

C $\{y|-3<y<3.25\}$

D $\{y|-3<y<3.25\}$

11. Evaluate $f(x)=x^2-8$ **for** $f(x-3)$.

A $x-17$

B x^2-17

C x^2+1

D x^2-6x+1

12. Identify the roots of the function.

$\square = x^2$

$\square = 1$

$\boxed{} = x$

A $\dfrac{4}{3}$ and -1

B $3, 4,$ and 7

C $\dfrac{4}{3}$ and 1

D $-\dfrac{4}{3}$ and -1

Hot Spot Item – You will be asked to plot points on a coordinate plane. If you don't use the "arrow" key to plot the points, your answer will not be considered answered. "AAA" (Always use the arrow key) DO NOT USE THE "DOT" KEY. Make sure you plot all points or the problem will be considered incorrect.

13. Identify the zeroes of the graphed function by placing a point at each zero.
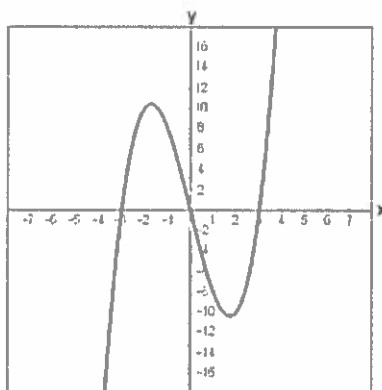
Click and Drag. These questions give you the choices for your answer or answers. You must click on each correct answer and drag it to the appropriate box. You must get all of them correct to get the answer correct. For our purposes, just write the correct answers in the boxes.

14. Identify the domain and range of the function by clicking and dragging from the choices given.
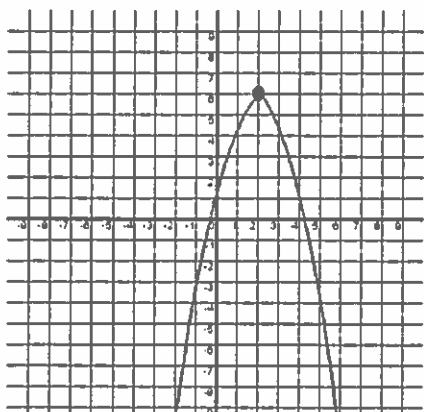
$\{x\,|\,-2<x<6\}$	$\{y\,|\,y=6\}$
$\{y\,|\,y\leq6\}$	$\{x\,|\,-2\leq x\leq6\}$
$\{x\,|\,x=-2 \; and \; x=6\}$	$\{y\,|\,y<6\}$
$\{y\,|\,y=\mathbb{R}\}$	$\{x\,|\,x=\mathbb{R}\}$

Domain

Range

A. 7 SKILLS CHECKLIST: *I can...*
- ☐ Determine whether a relation, represented by a set of ordered pairs, a table, or a graph is a function.
- ☐ Identify the domain, range, zeros, and intercepts of a function presented algebraically and graphically.
- ☐ For each x in the domain of f, find f(x).
- ☐ Represent relations and functions using multiple representations and convert between.
- ☐ Detect patterns in data and represent arithmetic and geometric patterns algebraically.

SOL A.8

The student, given a situation in a real-world context, will analyze a relation to determine whether a direct or inverse variation exists, and represent a direct variation algebraically and graphically and an inverse variation algebraically.

HINTS and NOTES

Direct Variation-

- $\frac{y}{x} = k$ or $y = kx$ is the form of a direct variation equation, where k is the constant of variation
- y-intercept is always zero
- The constant of the function is always the slope
- Graphs of Direct Variation equations always cross through the origin
- The constant can be negative or positive

Inverse Variation-

- $xy = k$ or $y = \frac{k}{x}$ is the form of an inverse variation equation, where k is the constant
- As input values increase, output values decrease and vice versa
- Graphs of Inverse Variations are not linear

Given: y varies directly as x
- Identify what number times x outputs the given y and repeat rule to find other values
- Use a proportion to find missing values

Given: y varies inversely as x
- Identify the product of x and y as the constant and use it to find other x, y values

PRACTICE A.8

1. Assume that y varies directly with x. If y is 24 when x is 3, find y when is 4.

   A 2

   B $\frac{28}{3}$

   C 18

   D 32

2. At a given time and place, the height of an object varies directly as the length of its shadow. If a flagpole 6 meters high casts a shadow 10 meters long, find the height of a building that casts a shadow 45 meters long.

   A 24 meters

   B 27 meters

   C 75 meters

   D $133\frac{1}{3}$ meters

3. In the table below, determine the equation of variation and identify if it is a direct or an inverse variation.

x	5	40	2	-10
y	8	1	20	-4

   A $y = 1.6x$, Direct

   B $y = 1.6x$, Inverse

   C $xy = 40$, Direct

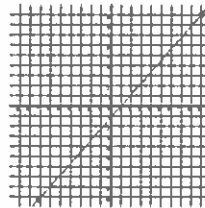   D $xy = 40$, Inverse

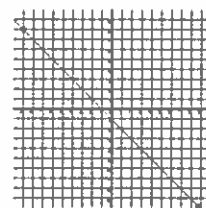4. **Which equation is a direct variation that includes the point (-1, 1) ?**

    A $y=x$

    B $y=-x$

    C $y=x-1$

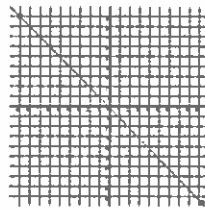   **D** $y=x+1$

5. **Which graph below is a direct variation?**
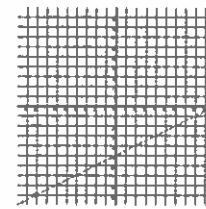
    A

    B

    C

    D

6. **Assume that y varies inversely as x. If $y=24$ when $x=12$, find y when $x=-24$.**

    A $y=-62$

    B $y=-248$

    C $y=62$

    D $y=248$

Put your answer in the box. These are open-ended questions. Work them out write your answer in the box (on the computer you would type your answer in the box being sure to put it in appropriate form, simplest fraction, decimal, etc.) For our purposes, you will write your answer in the box.

7. The cost of bananas varies directly with their weight. Miguel bought $3\frac{1}{4}$ pounds of bananas for $1.12. Write an equation that relates the cost of bananas to their weight. Then find the cost of $4\frac{3}{4}$ pounds of bananas.

Equation   **Cost**

Highlight each correct answer. These questions give you choices. You must click on each correct answer and make sure you mark every answer that is correct. If you forget one, it will be incorrect. Circle each correct answer. More than one answer may be selected.

8. Highlight each graph which is a direct variation.
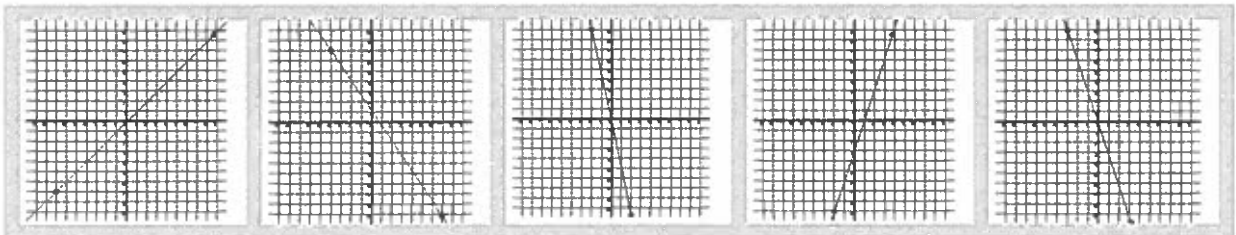
9. Highlight each function which is an inverse variation

	$(f)x = -\dfrac{1}{2}x$	$f(x) = \dfrac{16}{x}$	$f(x) = \dfrac{x}{16}$	Rate (mph)	Time (h)
				3	12
				6	6
				9	4
				12	3

Click and Drag. These questions give you the choices for your answer or answers. You must click on each correct answer and drag it to the appropriate box. You must get all of them correct to get the answer correct. For our purposes, just write the correct answers in the boxes.

10. Identify each situation as being Direct or Inverse variations by clicking and dragging the words to their proper place. Not all of the words will be used.

Cost of tickets and number of tickets	
Amount of gasoline used and distance traveled	
Speed of vehicle and time spent on road	
Amount of gasoline in tank and the time traveled	
Amount of time studying and the score on your tests	

Direct Variation	Direct Variation	Direct Variation	Direct Variation	Direct Variation
Inverse Variation	Inverse Variation	Inverse Variation	Inverse Variation	Inverse Variation

A.8 SKILLS CHECKLIST: *I can...*
☐ Given a situation, including a real world situation determine if a direct or inverse variation exists
☐ Write an equation for a direct or inverse variation.
☐ Graph an equation representing a direct variation, given a set of data.

SOL A.9

The student, given a set of data, will interpret variation in real-world contexts and calculate and interpret mean absolute deviation, standard deviation, and z-scores.

HINTS AND NOTES

Variance, standard deviation, and mean absolute deviation measure the dispersion of the data.

Mean Absolute Deviation (MAD) – average absolute value difference between data elements and the mean **Mean Absolute Deviation** is the deviation method used when there are outliers because it is less affected by outlier data than the variance and standard deviation.

Mean Absolute Deviation=

$$\frac{\sum_{i=1}^{n}|x_i - \mu|}{n}$$

Variance – average of the squared differences between the data elements and the mean.

$$\text{Variance } (\sigma^2) = \frac{\sum_{i=1}^{n}(x_i - \mu)^2}{n}$$

Standard Deviation – square root of the variance so your numbers are like your data elements.

- The larger the Standard Deviation the more spread out the data
- The smaller the Standard Deviation the more clustered about the mean

Standard Deviation-

$$(\sigma) = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \mu)^2}{n}}$$

1. The heights of 750 students at a local school were recorded and found to be approximated by this normal curve. What could the mean and standard deviation for these data be?

Height (in inches)
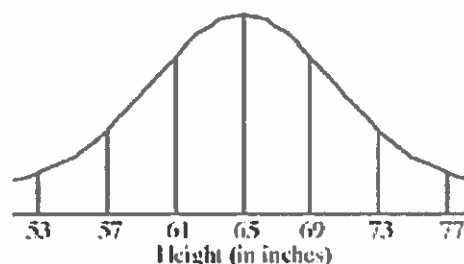
A 69, 5
B 65, 8
C 65, 4
D 53, 4

2. A set of data that is normally distributed has a mean of 35.6 and standard deviation of 2.5. Which number is between 1 and 2 standard deviations of the mean?

A 29
B 34.1
C 38.3
D 41.2

3. The class average on a math test was 84.5 and the standard deviation was 4.4. Find the z-score for a test score of 94.

A 21.36
B 2.16
C -2.16
D -21.36

z-score – describes how many standard deviations an element is above or below the mean. (Data should be normally distributed)

- Negative z score means it is below the mean
- Positive z score means it is above the mean

You can use z- score with standard deviation to find the actual value of a missing element.

$$\text{z-score}\ (z) = \frac{x - \mu}{\sigma}$$

TI-83 Calculator Help
- Press STAT
- Press Edit
- Enter data into L1
- Press STAT
- Choose option 1:1-Var stats
- Press ENTER (be sure you put data into L1, or you will have to list the name of the list used for ex L2, or L3)

```
1-Var Stats
 x̄=45
 Σx=630
 Σx²=29700
 Sx=10.19049331
 σx=9.819805061
↓n=14
```

$\bar{x}$ = arithmetic mean of the data set
Σx = sum of the x values
Σx^2 = sum of the x^2 values
Sx = sample standard deviation
σx = population standard deviation
n = number of data points (elements)

NOTE: "σx" will represent the standard deviation (σ). Squaring σ will yield the variance (σ^2).

If you are finding the statistics for 2 sets of data at once, follow the same steps as above except choose option 2: 2-Var Stats. It will show you both sets of data respectively.

4. Determine the number of standard deviations that includes all data values listed for the situation.

The mean height of a tree in an orchard is 11.8 feet; the standard deviation is 1.43 feet.

12.5 ft, 9.8 ft, 13.5 ft, 11.2 ft, 12.3 ft, 14.2 ft, 11.7 ft, 9.8 ft, 12.6 ft, 10.4 ft

A 1 standard deviations
B 2 standard deviations
C 3 standard deviations
D 4 standard deviations

5. The data set shown has a mean of 36.3 and a standard deviation of 6.6, rounded to the nearest tenth.

$$\{22,29,32,33,35,36,37,39,40,42,43,48\}$$

How many of these data points have a z-score greater than 0.3?

A 3
B 4
C 5
D 6

7. This table shows data on the number of dollars raised during a fundraiser for four different classes and for one student in each class.

Number of dollars raised

	Mean for class	Standard Deviation for class	Student's z-score
Kathy	70	11	1.8
Liz	62	12	2.2
Chris	59	14	1.5
Mark	65	9	2.7

Which of the four students raised the greatest number of dollars?

A Kathy
B Elizabeth
C Chris
D Mark

Put your answer in the box. These are open-ended questions. Work them out write your answer in the box (on the computer you would type your answer in the box being sure to put it in appropriate form, simplest fraction, decimal, etc.) For our purposes, you will write your answer in the box.

8. **IQ scores are normally distributed with a mean of 100 and a standard deviation of 15. What would be the z-score for a student that scored a 125, and what does that mean?**

z-score =

9. **Calculate the standard deviation, variance, and mean absolute deviation for the Baseball and Basketball Salaries.**

MLB Salaries (2012)		NBA Salaries (2012)	
Player	**Base Salary (in millions of dollars)**	**Player**	**Base Salary (in millions of dollars)**
Alex Rodriguez	$30	Kobe Bryant	$27.849
Johan Santana	$23.145	Dirk Nowitzki	$20.907
Mark Teixeira	$23.125	Amare Stoudemire	$19.948
C.C. Sabathia	$23	Carmelo Anthony	$19.887
Joe Mauer	$23	Jow Johnson	$19.752
Prince Fielder	$23	Dwight Howard	$19.536
Adrian Gonzalez	$21.857	Pau Gasol	$19
Cliff Lee	$21.5	Chris Paul	$17.779
Miguel Cabrera	$21	LeBron James	$17.545
Vernon Wells	$21	Chris Bosh	$17.545

http://www.spotrac.com/top-salaries/mlb/   http://www.spotrac.com/top-salaries/nba/

| **Standard Deviation**	**Variance**	**MAD**	**Standard Deviation**	**Variance**	**MAD**

Highlight each correct answer. These questions give you choices. You must click on each correct answer and make sure you mark every answer that is correct. If you forget one, it will be incorrect. Circle each correct answer. More than one answer may be selected.

10. The data on scores in a classroom for 39 students is summarized in the histogram
    - **The mean score is 74.2**
    - **The standard deviation of the data is 17.5**

    On the histogram, identify each interval that may have data points within 1.5 standard deviations of the mean. Click on the bar to choose each interval you want to select. You must select all correct intervals.

Final Scores
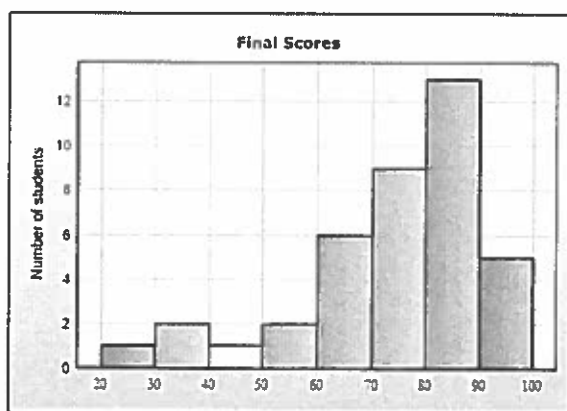
A.9 Skills Checklist: *I can...*

□ Analyze descriptive statistics to determine the implications for the real-world situations from which the data was derived.

□ Given data, including data in a real-world context, calculate and interpret the mean absolute deviation of a data set.

□ Given the data, including data in a real-world context, calculate the variance and standard deviation of dataset and interpret the standard deviation.

□ Given data, including data in a real world context, calculate and interpret z-scores for a data set.

□ Explain ways in which standard deviation addresses dispersion by examining the formula for standard deviation.

□ Compare and contrast mean absolute deviation and standard deviation in a real-world context.

SOL A.10
The student will compare and contrast multiple univariate data sets, using box-and-whisker plots.

HINTS and NOTES

Mean (average)
- Add up all the data and divide by number of data

Median (middle)
- Put data in numerical order and find the middle
- If there are an even number of data, find the middle two and average them
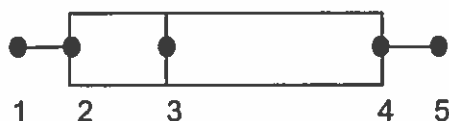
Mode (most)
- Data that occurs the most often
- If all data occurs the same amount of time, then the mode is NO MODE

Range
- The difference between the largest data point and the smallest data point

Box and Whisker
1. Lower extreme (Lowest point)
2. Q1 (median of lower half)
3. Q2 (Median)
4. Q3 (median of upper half)
5. Upper Extreme (Highest point)

- Each quartile represents 25% of the data set.
- The IQR is the interquartile range Q3 – Q1

PRACTICE A.10

1. Only one of the box-and-whisker plots correctly displays data about the ages of team members on a company baseball team. The statements below are all true about the team. Use the statements to correctly choose the box-and-whisker plot.
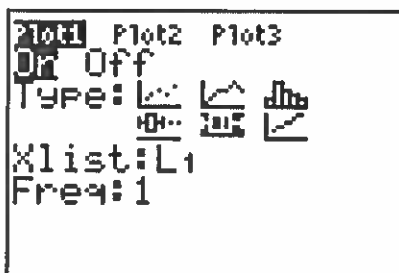
- **The youngest member is 20 years old.**
- **About 75% of the members are between 25 and 34 years old.**
- **No one is older than 34 years old.**
- **About 50% of the members are at least 29 years old.**

A
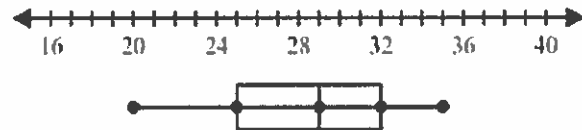
B
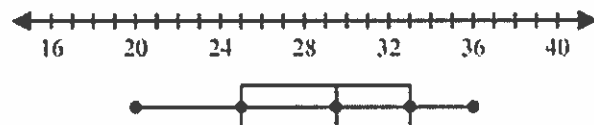

C
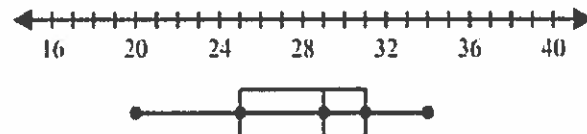
D
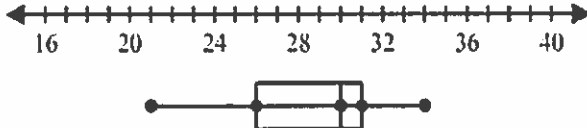
TI-83 Calculator Help

- Press STAT
- Press Edit
- Enter data into L1
- 2nd STAT PLOT (Y=)
- Plot 1 – ENTER
- Turn Plot 1 ON
- Choose the Box and Whisker Plot highlighted below.

- Press ZOOM.
- Go to option 9 (ZOOM STAT)
- Press TRACE
- Use the arrow keys to move the cursor to each quartile.

** If all you want is the numerical stats, follow the steps for finding the Standard Deviation with the TI-83 Calculator. Just scroll down past the standard deviation and the quartiles will be given.

---

2. **What percent of the scores in Mrs. Abbott's class are between 30 and 80?**
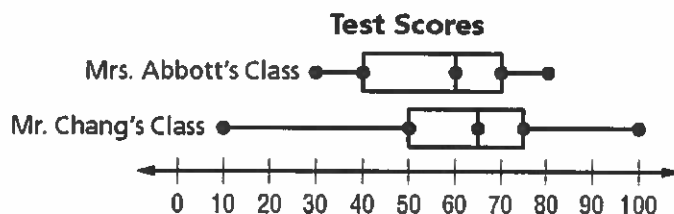
A   25%
B   40%
C   50%
D   75%

3. **Which statement is true about the double box and whisker plot?**
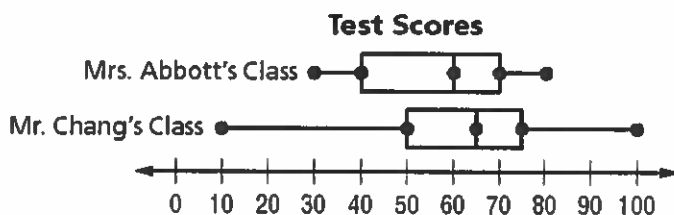
A   The median score of Mrs. Abbott's class is 5 points higher than the median score of Mr. Chang's class

B   The range of the scores of Mrs. Abbott's class is larger than the range of the test scores in Mr. Chang's class

C   Mrs. Abbott's class scores were largely dispersed compared to Mr. Chang's class.

D   The interquartile range of Mrs. Abbott's class is greater than the interquartile range of Mr. Chang's class

Highlight each correct answer. These questions give you choices. You must click on each correct answer and make sure you mark every answer that is correct. If you forget one, it will be incorrect. Circle each correct answer. More than one answer may be selected.

4. **Identify the true statements regarding this data displayed.**

Scores on a Math
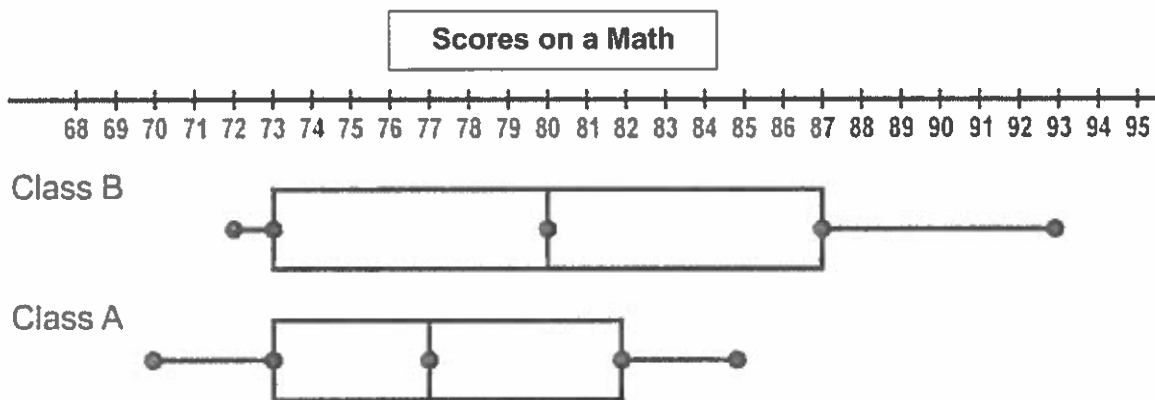
Class A scores are dispersed more widely than Class B	As a whole, the students in Class A scored better than those in Class B	The interquartile range of Class B is approximately 22
The median score for Class A is lower than Class B	The upper extreme of Class A is an 85	The lower extreme of Class B is a 93
The range of scores in the lower 25th percentile in Class A is larger than the range of the lower 25th percentile of Class B	There are more students in Class B than in Class A.	Class B scores are dispersed more widely than Class A

A.10 SKILLS CHECKLIST: *I can...*
☐ Compare, contrast, and analyze data, including data from real-world situations displayed in box-and-whisker plots.

SOL A.11

The student will collect and analyze data, determine the equation of the curve of best fit in order to make predictions, and solve real-world problems, using mathematical models. Mathematical models will include linear and quadratic functions.

HINTS and NOTES

** Curve of best fit can be linear or quadratic. You need to decide from the actual graph whether it will be linear or quadratic in order to determine the equation

TI-83 HELP

To calculate Curve of Best Fit
1. Enter ordered pairs or data set into L1, L2 in your calculator found under the STAT button, using EDIT tab
2. 2nd MODE to exit data entry mode
3. Choose STAT again, and this time arrow right to highlight CALC tab.
4. Choose option #4 for Linear (LinReg) and #5 for a Curve (QuadReg)
5. Press ENTER (as long as you inputted your data into L1, L2- if not list the name of your lists first then hit enter)
6. Interpret data provided

To predict data
1. In WINDOW, make sure that the prediction amt. is included in the range of the x:min and x:max
2. Also, make sure that the equation is in Y1 and you have graphed the line with the data
3. 2nd TRACE – Value
4. Type in prediction amount
5. Press ENTER

PRACTICE A.11

1. Bill rode his bike to a store 5 kilometers from his house. The table shows the distance from the store paired with the number of minutes after leaving his house.

Minutes (x)	Kilometers from Store (y)
0	5
3	4
5	3.2
8	2.9

A $y=-0.2x+4.5$
B $y=-0.2x+6.1$
C $y=-0.3x+4.9$
D $y=-0.3x+6.4$

2. The scatter plot shows the average price of a major-league baseball ticket from 1997 to 2006. Estimate the cost of a ticket in 2012.
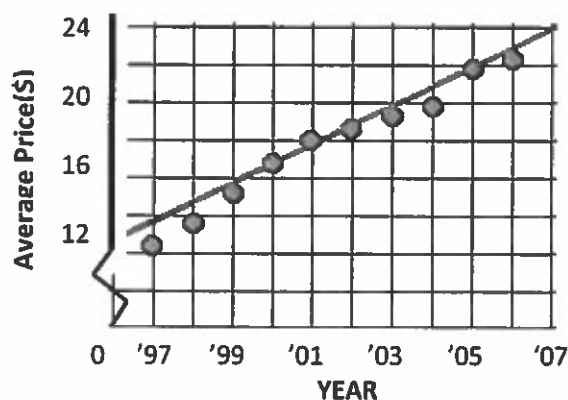
A 28
B 30
C 32
D 34

Put your answer in the box. These are open-ended questions. Work them out write your answer in the box (on the computer you would type your answer in the box being sure to put it in appropriate form, simplest fraction, decimal, etc.) For our purposes, you will write your answer in the box.

3. The State of California keeps track of how many third grade students score proficient or higher on the English Language Arts CST (like our SOL tests) each year.

Year	2006	2007	2008	2009	2010
Percent	36	37	38	44	44

Find the equation of curve of best fit. Use function notation.

5. Using the table, predict the percentage of California third graders who will score proficient or higher on the English Language Arts CST in 2013.

Year	2006	2007	2008	2009	2010
Percent	36	37	38	44	44

6. A basketball is dropped from a height of 200 cm. The table shows how high it bounces on each bounce. Write the equation for curve of best fit. Use function notation. Round to the nearest hundredth, if needed.

Bounce Number	0	1	2	3	4	5	6	7	8
Maximum Height (cm)	200	120	72	44	26	16	10	6	4

A.11 SKILLS CHECKLIST: *I can*...

- ☐ Write an equation for a curve of best fit, given a set of no more than twenty data points in a table, a graph, or a real-world situation.
- ☐ Make predictions about unknown outcomes, using the equation of the curve of best fit.
- ☐ Design experiments and collect data to address specific, real-world questions
- ☐ Evaluate the reasonableness of a mathematical model of areal world situation.