Grade: Algebra I

Enduring Skill 1:

Students will develop an understanding of linear equations and inequalities (including systems of each) and apply related solution techniques.

Demonstrators and Related Standards:

1. Solve linear equations and inequalities with one and two variables. A.REI.3, A.CED.1, A.CED.2

2. Analyze and explain the process of solving an equation. A.REI.1

3. Develop fluency writing, interpreting, and translating between various forms of linear equations and inequalities and using them to solve problems. A.SSE.1, A.CED.1, A.CED.2, A.CED.3, A.REI.1, A.REI.3

4. Apply graphical and algebraic methods to analyze and solve systems of linear equations in two variables. A.REI.6, A.CED.3

5. Compare and contrast linear and exponential functions. F.IF.7, A.REI.3

Assessment Items:

1. ES 1, Demonstrator 1, Standards A.REI.3, A.CED.1, A.REI.3

What are the solutions of the inequality $4x + 6 < -6$?

a. $x < -3$ b. $x > -3$ c. $x > -6$ d. $x < 6$

2. ES 1, Demonstrator 1 and 2, Standards A.REI.1, A.CED.1, A.REI.3

Solve the equation below and justify each step using the properties of equality.

$26 = -16 - 8x$

3. ES 1, Demonstrator 1 and 3, Standards A.REI.3, A.CED.1

Angela and Neil are going to the movies. They each bought a medium size popcorn, and Neil got a small soft drink. Angela had a $5 gift certificate to put toward the cost, and Neil paid the rest, which came to $27.90. A movie ticket costs $10.00 and a medium popcorn costs $5.50. How much does a soft drink cost at the theater?

a. $1.90 b. $7.40 c. $2.90 d. $17.40

4. ES 1, Demonstrator 3, Standards A.CED.2, A.CED.3

You received a $12.00 credit for a website that sells movie and music files. A movie costs $1.80 to download and a song costs $.60. The equation , where *m* is the number of movies and *s* is the number $ songs, models the situation. Using the $12.00 credit how many songs can you download if you download three movies?

5. ES 1, Demonstrator 4, Standards A.CED.3, A.REI.6

Tom has a collection of 30 CDs and Nita has a collection of 18 CDs. Tom is adding 1 CD a month to his collection while Nita is adding 5 CDs a month to her collection. Find the number of months after which they will have the same number of CDs.

a. 1 month c. 2 months

b. 3 months d. 33 months

6. ES 1, Demonstrator 4, Standards A.REI.6, A.CED.3

What is the solution of the system? Use substitution.

$3x + 2y = 7$
$y = –3x + 11$

a. (6, –3) b. (6, –7) c. (-4, 9.5) d. (5, –4)

7. ES 1, Demonstrator 4, Standards A.REI.6, A.CED.3

How many solutions does the system have?

$x = - 4y + 4$
$2x + 8y = 8$

a. one solution b. two solutions

c. infinitely many solutions d. no solution

8. ES 1, Demonstrator 3, Standards A.CED.1, A.REI.1, R.EEI.3

A copy center offers its customers two different pricing plans for black and white photocopies of 8.5 in. by 11 in. pages. Customers can either pay $0.08 per page or pay $7.50 for a discount card that lowers the cost to $0.05 per page. Write and solve an equation to find the number of photocopies for which the cost of each plan is the same.

9. ES 1, Demonstrator 1, Standards A.REI.3, A.CED.1

Which equation is an identity?

a. $11 - (2v + 3) = - 2v - 8$ c. $7m - 2 = 8m + 4 - m$
b. $5w + 8 - w = 6w - 2(w - 4)$ d. $8y + 9 = 8y - 3$

10. ES 1, Demonstrator 1, Standards A.REI.3, A.CED.1

Which equation has no solution?

a. $8 - (5v + 3) = 5v - 5$

b. $3m - 6 = 5m + 7 - m$

c. $3w + 4 - w = 5w - 2(w - 2)$

d. $3w + 4 - w = 5w - 2(w - 2)$

11. ES 1, Demonstrator 1, Standards A.REI.3, A.CED.1

What is the solution of the following equation?

$2(h - 8) – h = h - 16$

a. 8

b. -8

c. Infinitely many solutions

d. no solution

12. ES 1, Demonstrator 3, Standards A.CED.2, A.CED.3

Write the slope intercept form of the equation of the line through the given point with the given slope.

(5, 1) and slope = 1

a. $y = - 4x + 1$
b. $y = x - 4$
c. $y = - x - 4$
d. $y = -3x - 4$

13. ES 1, Demonstrator 3, Standards A.CED.2, A.CED.3

Write the slope intercept form of the equation of the line: $x - 3 = - y$

a. $y = - 3x - 1$
b. $y = x - 1$
c. $y = 3x - 1$
d. $y = - x + 3$

14. ES 1, Demonstrator 3, Standards A.CED.2, A.CED.3

Write the slope intercept form of the equation of each line given the slope and y-intercept.

Slope = 0 y-intercept = - 2

a. y = -½
b. x = 2
c. y = -2
d. x = 1

15. ES 1, Demonstrator 3, Standards A.CED.2, A.CED.3

Write the slope-intercept form of the equation of the line through (-5, 1) and parallel to y = - 3/5x

a. y = -2x + 1
b. y = -x - 2
c. y = x - 2
d. y = - 3/5x - 2

16. ES 1, Demonstrator 3, Standards A.CED.2, A.CED.3

Write the slope-intercept form of the line through (-5, -2) and perpendicular to y = -x +5

a. y = x +3
b. y = 3x + 2
c. y = - x - 7
d. y = 2x + 3

Algebra 1

Enduring Skill 2:

Students will understand function notation and develop the concepts of domain and range to move beyond viewing functions as processes that take inputs and yield outputs.

Demonstrators and Related Standards:

1. Interpret arithmetic sequences as linear functions and geometric sequences as exponential functions. F.BF.1, F.LE.3, F.LE.2, F.BF.2

2. Learn function notation and develop the concepts of domain and range. F.IF.1, F.IF.2, F.LE.5

3. Explore many examples of functions, including sequences; and interpret functions given graphically, numerically, and translate between representations. F.IF.9, F.IF.5, F.IF.7, F.IF.4

4. Extend their understanding of integer exponents to consider exponential functions. F.IF.1, F.IF.4, F.IF.2

5. Interpret arithmetic sequences as linear functions and geometric sequences as exponential functions. F.BF.1, F.BF.2, F.LE.5

Assessment Items:

1. ES 2, Demonstrator 2, Standards F.IF.1, F.IF.2, F.LE.5

Write a function for the situation. Is the graph *continuous* or *discrete*?
A movie store sells DVDs for $11 each. What is the cost, *C*, of *n* DVDs?

a. C = 11n; continuous
b. C = 11 + n; discrete
c. C = 11 + n; continuous
d. C = 11n; discrete

2. ES 2, Demonstrator 2, Standards F.IF.1 F.IF.2, F.LE.5

Write a function for the situation. Is the graph *continuous* or *discrete*?
A produce stand sells roasted peanuts for $1.90 per pound.
What is the cost, *C*, of *p* pounds of peanuts?

a. C = 1.90p; continuous
c. C = 1.90 + p; continuous

b. C = 1.90p; discrete
d. C = 1.90 + p; discrete

3. ES 2, Demonstrator 3, Standards F.IF.9, F.IF.5, F.IF.7, F.IF.4

Write a function rule that gives the total cost *c*(*p*) of *p* pounds of sugar if each pound costs $0.59.

a. c(p)=59p
c. c(p)= p + 0.59

b. c(p)= p / .59
d. c(p)=0.59p

4. ES 2, Demonstrator 3, Standards F.IF.9, F.IF.5, F.IF.7, F.IF.4

Crystal earns $5.50 per hour mowing lawns. Write a rule to describe how the amount of money earned, *m,* earned is a function of the number of hours, *h,* spent mowing lawns. How much does Crystal earn if she works 3 hours and 45 minutes?

a. m(h) = 3h + 45 ; $61.50
c. m(h)=5.50h; $18.98

b. m(h)= h /5.50 ; $0.68
d. m(h)= 5.50h; $20.63

5. ES 2, Demonstrator 1, Standards F.BF.1, F.LE.3, F.LE.2, F.BF.2

Describe a pattern for the sequence. What are the next two terms of the sequence: 24, 22, 20, 18, . . .

a. multiply the previous term by –2; –36, 72

b. multiply the previous term by –2; 16, 72

c. subtract 2 from the previous term; 16, 14

d. add 2 to the previous term; 20, 22

Algebra 1

Enduring Skill 3:

Students will develop an understanding of various forms of quadratic expressions.

Demonstrators and Related Standards:

1. Analyze, interpret, and construct graphs of quadratic functions (parabolas). F.IF.4, F.IF.5, F.IF.7a, F.IF.9, F.BF.3

2. Build quadratic functions that model relationships between two quantities. F.IF.8, F.BF.1, F.IF.9

3. Identifying real solutions of a quadratic equation. F.IF.8.a; A.SSE.2; A.SSE.3a,b; A.REI.4a,b

Assessment Items:

1. **ES 3, Demonstrator 3, Standards F.IF.8a, A.SSE.2, A.SSE.3a, A.REI.4b**

$2x^2 = 81$

A. $-\frac{2\sqrt{9}}{9}, \frac{2\sqrt{9}}{9}$ B. $\frac{9\sqrt{2}}{2}$ C. $\frac{9}{2}$ D. $-\frac{9\sqrt{2}}{2}, \frac{9\sqrt{2}}{2}$

2. **ES 3, Demonstrator 3, Standards F.IF.8a, A.SSE.2, A.SSE.3a, A.REI.4a,b**

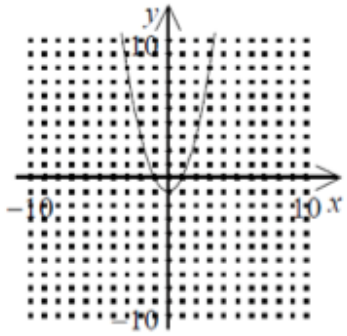
$4x^2 + 13x = 12$

A. $-4, \frac{3}{4}$ B. $4, -\frac{4}{3}$ C. $-4, \frac{4}{3}$ D. $4, -\frac{3}{4}$

3. **ES 3, Demonstrator 1, Standard F.IF.7a**

Graph $y = x^2 + 1$.

[A]



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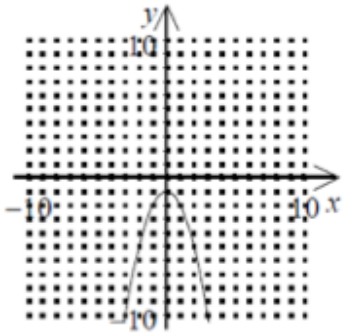

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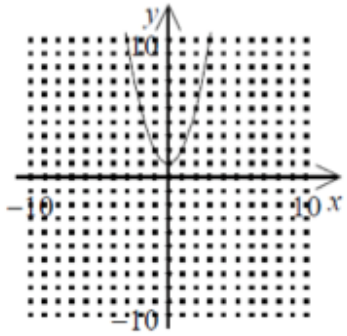

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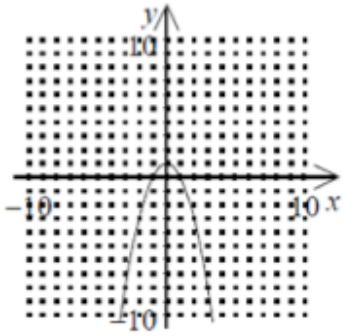


4. **ES 3, Demonstrator 3, Standards F.IF.8a, A.SSE.2, A.SSE.3a, A.REI.4b**

Solve $16x = x^2$

A. 0, 4 B. 0,16 C. 1,16 D. – 4, 4

5. **ES 3, Demonstrator 3, Standards F.IF.8a; A.SSE.2; A.SSE.3b; A.REI.4a,b**

Solve for x: $ax^2 + bx + c = 0$.

[A] $b+\frac{\sqrt{b^2-4ac}}{2a}$, $b-\frac{\sqrt{b^2-4ac}}{2a}$

[B] $\frac{b+\sqrt{b^2-4ac}}{2a}$, $\frac{b-\sqrt{b^2-4ac}}{2a}$

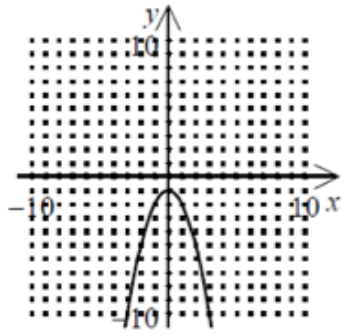
[C] $-b+\sqrt{\frac{b^2-4ac}{2a}}$, $-b-\sqrt{\frac{b^2-4ac}{2a}}$

[D] $\frac{-b+\sqrt{b^2-4ac}}{2a}$, $\frac{-b-\sqrt{b^2-4ac}}{2a}$

6. **ES 3, Demonstrator 1, Standard F.IF.7a**

Identify the graph of $y = x^2$.

[A]



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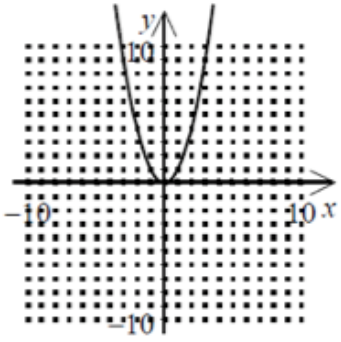

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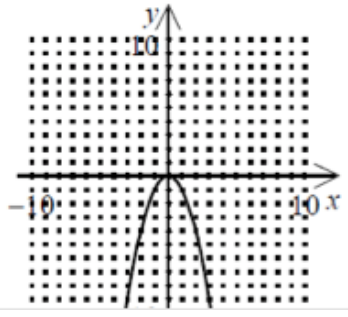

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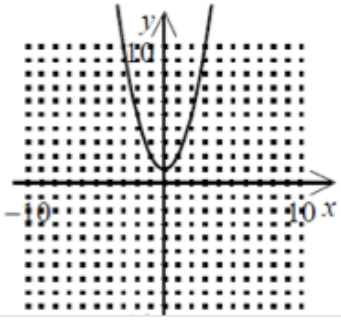

7. **ES 3, Demonstrator 3, Standards F.IF.8a, A.SSE.2, A.SSE.3a, A.REI.4b**

Solve $49x^2 - 9 = 0$

$A.\ -\frac{9}{49},\ \frac{9}{49}$ $B.\ -\frac{49}{9},\ \frac{49}{9}$ $C.\ -\frac{7}{3},\ \frac{7}{3}$ $D.\ -\frac{3}{7},\ \frac{3}{7}$

8. **ES 3, Demonstrator 3, Standards F.IF.8a, A.SSE.2, A.SSE.3a, A.REI.4a,b**

Solve $x^2 = 5x + 3$

A. $\frac{-5+\sqrt{37}}{2}, \frac{-5-\sqrt{37}}{2}$ B. $\frac{5+\sqrt{37}}{2}, \frac{5-\sqrt{37}}{2}$ C. $-5+\sqrt{37},\ -5-\sqrt{37}$ D. $5+\sqrt{37},\ 5-\sqrt{37}$

9. **ES 3, Demonstrator 3, Standards F.IF.8a, A.SSE.2, A.SSE.3a, A.REI.4a,b**

Solve $4x^2 - 21x - 49 = 0$

A. $7, \frac{7}{4}$ B. $-7, \frac{7}{4}$ C. $-7, -\frac{7}{4}$ D. $7, -\frac{7}{4}$

10. **ES 3, Demonstrator 3, Standards F.IF.8a, A.SSE.2, A.SSE.3a, A.REI.4a,b**

Solve $x^2 - 3x - 10 = 0$

A. -2, -5 B. -5, 2 C. -2, 5 D. 2, 5

11. **ES 3, Demonstrator 3, Standards F.IF.8a, A.SSE.2, A.SSE.3a, A.REI.4a,b**

What are the zeros of the quadratic function $f(x) = x^2 + 3x + 1$?

A. $\frac{-3\pm\sqrt{5}}{2}$ B. $\frac{-3\pm\sqrt{13}}{2}$ C. $\frac{3\pm\sqrt{5}}{2}$ D. $\frac{3\pm\sqrt{13}}{2}$

12. **ES 3, Demonstrator 3, Standards F.IF.8a, A.SSE.2, A.SSE.3a, A.REI.4a,b**

What is the solution set for $5x^2 + 6 = 8x$?

$A.-\frac{3}{5}\pm\frac{i\sqrt{31}}{5}$ $B.\frac{4}{5}\pm\frac{2i\sqrt{14}}{5}$ $C.-\frac{4}{5}\pm\frac{i\sqrt{14}}{5}$ $D.\ \frac{4}{5}\pm\frac{i\sqrt{14}}{5}$

13. **ES 3, Demonstrator 3, Standards F.IF.8a, A.SSE.2, A.SSE.3a, A.REI.4a,b**

What are the roots of the equation $x^2 + 2x + 12 = 0$?

$A.\ -1 \pm i\sqrt{11}$ $B.-2 \pm i\sqrt{11}$ $C.-2 \pm 2i\sqrt{11}$ $D.-1 \pm 2i\sqrt{11}$

14. **ES 3, Demonstrator 3, Standards F.IF.8a, A.SSE.2, A.SSE.3a, A.REI.4a,b**

What are the solutions for $x^2 = -4x + 7$?

$A.\ -2 \pm \sqrt{11}$ $B.\ -4 \pm \sqrt{23}$ $C.-7, 1$ $D.\ 2 \pm \sqrt{3}$

15. **ES 3, Demonstrator 3, Standards F.IF.8a, A.SSE.2, A.SSE.3a, A.REI.4a,b**

What is the solution set of $\frac{2}{3}x^2 + 1 = x - \frac{1}{2}$?

$A.\ \frac{3 \pm 3i\sqrt{3}}{4}$ $B.\ \frac{3 \pm 3\sqrt{3}}{4}$ $C.\frac{-3 \pm 3i\sqrt{3}}{4}$ $D.\ \frac{-3 \pm i\sqrt{3}}{4}$

16. **ES 3, Demonstrator 3, Standard F.IF.8a**

The formula $L = 0.1s^2 - 3s + 22$ gives the approximate runway length required to land a small plane. L is the length of the runway, in feet, and s is the landing speed of the airplane, in feet per second. The pilot knows that the runway is 2,400 ft long. To the nearest foot per second, what is the maximum safe landing speed?

A. 50 B. 90 C. 140 D. 170

17. **ES 3, Demonstrator 3, Standards A.SSE.3a, A.REI.4a,b**

Which quadratic equation has only non-real complex roots?

$A.\ x^2 - 7x - 12 = 0$ $B.\ x^2 + 8x + 10 = 0$
$C.\ x^2 - x + 5 = 0$ $D.\ x^2 + 4x - 1 = 0$

18. **ES 3, Demonstrator 3, Standard A.REI.4a,b**

For the equation $x^2 - 4x + 4 = 9$, determine the discriminant.

A. -36 B. 0 C. 6 D. 36

19. **ES 3, Demonstrator 3, Standard A.REI.4a,b**

What condition will yield non-real zeros of a quadratic function $f(x) = ax^2 + bx + c$?

$A.\ -b < b^2$ $B.\ b^2 < 4ac$ $C.\ 2a < 0$ $D.\ b^2 > 4ac$

20. **ES 3, Demonstrator 3, Standards F.IF.8a; A.SSE.2; A.SSE.3a,b; A.REI.4a,b**

What are the solutions of $4x^2 = 3x - 2$?

$A.\ \frac{-3\pm\sqrt{41}}{8}$ $B.\ \frac{3\pm4\sqrt{2}}{8}$ $C.\ \frac{3\pm i\sqrt{35}}{8}$ $D.\ \frac{3\pm i\sqrt{23}}{8}$

21. **ES 3, Demonstrator 1, Standard F.BF.3**

Which function has the same range as $y = (x + 3)^2$?

$A.\ y = (x + 3)^2 - 2$ $B.\ y = x^2 + 9$ $C.\ y = 2(x - 3)^2 + 1$ $D.\ y = (x - 5)^2$

22. **ES 3, Demonstrator 3, Standards A.SSE.3a, A.REI.4a,b**

Ethan is working with the quadratic function $y = x^2 - 5x + 10$. Ethan needs to determine the number and type of roots for the equation using the discriminant. His solution is shown below. Explain what Ethan did correctly and what he did incorrectly, and then correct his mistakes.

Ethan's solution:
$b^2 - 4ac = -5^2 - 4(1)(10) = -25 - 40 = -65$
Since -65 < 0, there are 2 non-real solutions.