

ALGEBRAIC THINKING SELF-ASSESSMENT – ANSWER KEY

(1) Classify these numbers as odd, even, prime, composite, rational, irrational, whole, natural, and integer.

O = odd, E = even, P = prime, K = composite,
Q = rational, Ir = irrational, W = whole, N = natural, and
Z = integer

(a) 71 O, P, Q, W, N, Z

(b) -71 O, Q, Z

(c) $\frac{1}{5}$ Q

(d) 3.14 Q

(e) $3.3333\bar{3}$ Q

(f) $\sqrt{3}$ Ir

(g) $\sqrt{9}$ O, P, Q, W, N, Z

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(2) Using the letters a , b , and c , give example of the following properties:

(a) Associative $(a + b) + c = a + (b + c)$

(b) Commutative $a + b = b + a$

(c) Distributive $a(b + c) = ab + ac$

(d) Inverse $a + (-a) = 0$ $a \times \frac{1}{a} = 1$

(e) Identity $a + 0 = a$ $a \times 1 = a$

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(3) Evaluate:

(a) $4x + 7y$ when $x = -6$ and $y = 3$
 $4(-6) + 7(3) = -24 + 21 = -3$

(b) $6x^2 - 2y^2$ when $x = 4$ and $y = 10$
 $6(4^2) - 2(10^2) = 6(16) - 2(100) = 96 - 200 = -104$

(c) $(3x + 7)^2$ when $x = 4$
 $(3(4) + 7)^2 = (12 + 7)^2 = 19^2 = 361$

Simplify:

(d) $4y - x - y + 6x - x$
 $4y - y + 6x - x - x = 3y + 4x = 4x + 3y$

(e) $9q + 6p - 7p + q$
 $9q + q + 6p - 7p = 10q - p$

(f) $7a - 2b + 3c + 2b + 6a - 8b$
 $7a + 6a - 2b + 2b - 8b + 3c = 13a - 8b + 3c$

(g) $5(3x - 7y + 6) + 4x - 9$
 $15x - 35y + 30 + 4x - 9 = 19x - 35y + 21$

(h) $-2(6a + 7b) - 3a + 9b$
 $-12a - 14b - 3a + 9b = -15a - 5b$ or $-5(3a + b)$

(i) $4(a + 2b - 3c) + 6a - 7b$
 $4a + 8b - 12c + 6a - 7b = 10a + b - 12c$

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(4) Write each statement in symbols:

(a) eight times the sum of a number and 3
 $8(x + 3)$

(b) the product of 12 and a number
 $12x$

(c) six subtracted from three times a number
 $3x - 6$

(d) a number divided by six
 $\frac{x}{6}$

(e) the sum of a number and 14
 $x + 14$

(f) one number is 12 more than another number
 $x = y + 12$

(g) the sum of 6 times a number and half of another number
 $6x + \frac{y}{2}$

(h) the difference of 6 subtracted from a number
 $x - 6$

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(5) Solve:

(a) $9x - 10 = -5 - 2(x + 8)$ $x = -1$

(b) $26x - 13 = 65$ $x = 3$

(c) $\frac{x}{19} + 11 = 35$ $x = 456$

(d) $-3 - 2x = 11$ $x = -7$

(e) $-6(x + 6) = 0$ $x = -6$

(f) $\frac{x}{18} = 27$ $x = 486$

(g) $-9x = 45$ $x = -5$

(h) $\frac{x}{6} = -11$ $x = -66$

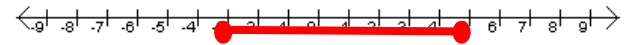
(i) $4(3x + 6) = 6(x + 4)$ $x = 0$



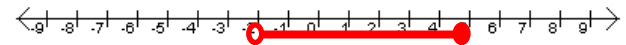
(6) Graph the following number ranges:

Note that square brackets and parentheses may also be used instead of closed circles and open circles.

(a) $-3 \leq x \leq 5$



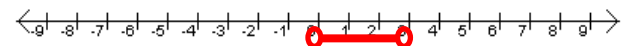
(b) $-2 < x \leq 5$



(c) $-3 \leq x < 0$



(d) $0 < x < 3$





(7) Solve:

(a) $3x - 2 \leq 5x + 3$ $x \geq -\frac{5}{2}$

(b) $2x + 3 < 8x - 2$ $x > \frac{5}{6}$

(c) $4(x + 7) \leq 2x + 31$ $x \leq \frac{3}{2}$

(d) $7(x - 3) > 5x - 14$ $x > \frac{7}{2}$

(e) $2x \geq 5x + 18$ $x \leq -6$

(f) $11x + 8 > 4x - 6$ $x > -2$



(8) Evaluate:

(a) $|8| = 8$

(b) $|-8| = 8$

(c) $-|-8| = -8$

(d) $|-9| + |4| = 13$

(e) $|9 - 4| = 5$

(f) $|9| - |4| = 5$



(9) Solve for the variable indicated:

Remember that algebra is case sensitive!

(a) $C = 2\pi r$, for r $r = \frac{C}{2\pi}$

(b) $V = lwh$, for w $w = \frac{V}{lh}$

(c) $A = \frac{1}{2}bh$, for b $b = \frac{2A}{h}$

(d) $I = prt$, for p $p = \frac{I}{rt}$

(e) $D = rt$, for t $t = \frac{D}{r}$

(f) $A = \pi r^2$, for r $r = \pm \sqrt{\frac{A}{\pi}}$

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(10)

(a) Find three consecutive, even numbers whose sum is 90.
28, 30, 32

(b) The length of a rectangle is twice its width. If the perimeter of the rectangle is 60 in., find its area. **200 in²**

(c) How much of a 16% solution is needed to combine with 34 ml of a 12% solution to make 50 ml of a 15% solution?
 $0.16x + 0.12(34) = 0.15(50) \rightarrow 21.375$ ml

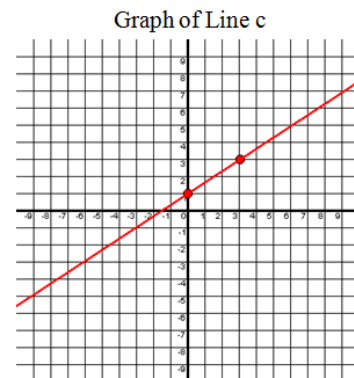
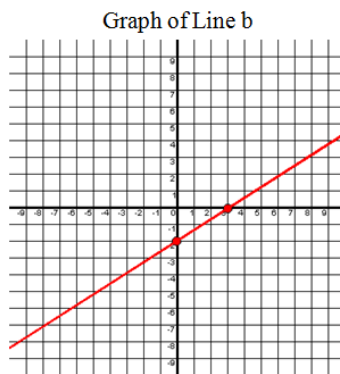
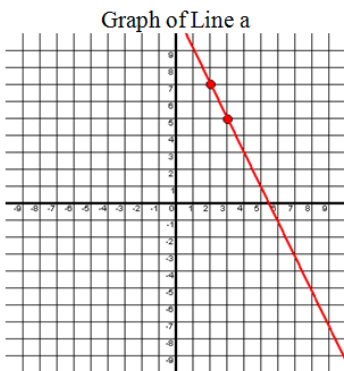
(d) A boat can travel 12 mi/hr in still water. If the boat can travel 5 mi downstream in the same time it takes to travel 3 mi upstream, what is the rate of the river's current?

$$\frac{5}{12 + c} = \frac{3}{12 - c} \rightarrow c = 3 \text{ m/hr}$$

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(11) Fill in the table below with all missing information, and then graph the lines on the grids below.

Line	Equation in Standard Form	Equation in Slope-Intercept Form	Slope	x-intercept	y-intercept	A non-intercept point on the line
a	(Manipulate the slope-intercept form) $2x + y = 11$	$y = -2x + 11$	-2	(Let $y = 0$, solve for x) $\frac{11}{2}$	(Substitute 3, 5 for x, y and solve for b) 11	(3, 5)
b	(Manipulate the slope-intercept form) $2x - 3y = 6$	$y = \frac{2}{3}x - 2$	$\frac{2}{3}$	3	-2	(Let $x = 6$, solve for y) (6, 2)
c	(Manipulate the slope-intercept form) $2x - 3y = -3$	$y = \frac{2}{3}x + 1$	$\frac{2}{3}$	(Let $y = 0$, solve for x) $-\frac{3}{2}$	1	(Let $x = 6$, solve for y) (6, 5)



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(12) Evaluate:

- (a) $6^3 \quad 6 \times 6 \times 6 = 216$
- (b) $-(3)^2 \quad -(3 \times 3) = -9$
- (c) $(-3)^2 \quad -3 \times -3 = 9$
- (d) $x^2 + x - 1$ when $x = 4$
 $4^2 + 4 - 1 = 16 + 4 - 1 = 19$
- (e) $6x(x - 2) + 4$ when $x = 3$
 $6(3)(3 - 2) + 4 = 18(1) + 4 = 22$

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(13) Simplify:

- (a) $\sqrt{81} = 9$
- (b) $\sqrt{150} = \sqrt{25 \times 6} = 5\sqrt{6}$
- (c) $\sqrt{\frac{4}{9}} \quad \frac{\sqrt{4}}{\sqrt{9}} = \frac{2}{3}$
- (d) $-\sqrt{100} = -10$
- (e) $\sqrt{756} \quad \sqrt{2 \times 2 \times 3 \times 3 \times 3 \times 7} = 6\sqrt{21}$

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(14) Solve:

(a) by substitution:

$$\begin{aligned}x - 2y &= -4 \\ y &= x + 1\end{aligned}$$

$$\begin{aligned}x - 2(x + 1) &= -4 \\ x - 2x - 2 &= -4 \\ -x - 2 &= -4 \\ -x &= -4 + 2 \\ -x &= -2 \\ x &= 2 \\ \text{Since } y &= x + 1 \\ y &= 2 + 1 \\ y &= 3 \\ \mathbf{(2, 3)}\end{aligned}$$

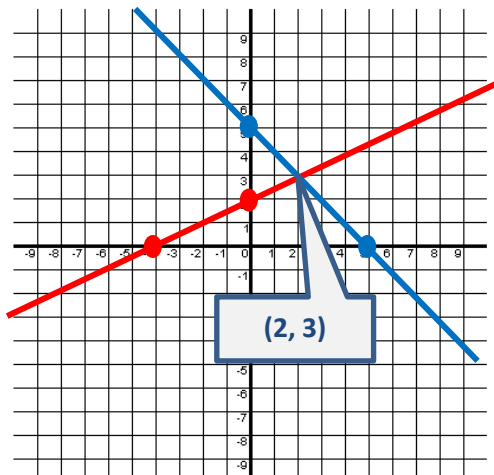
(b) by elimination:

$$\begin{aligned}x - 3y &= -4 \\ 2x + y &= -1\end{aligned}$$

$$\begin{aligned}x - 3y &= -4 \\ 6x + 3y &= -3 \quad (\times 3) \\ 7x &= -7 \\ x &= -1 \\ \text{Substitute into 2nd equ.} \\ 2(-1) + y &= -1 \\ -2 + y &= -1 \\ y &= -1 + 2 \\ y &= 1 \\ \mathbf{(-1, 1)}\end{aligned}$$

(c) by graphing:

$$\begin{aligned}x - 2y &= -4 \\ x + y &= 5 \\ \text{1st equ: } x\text{-int} &= -4 \text{ \& } y\text{-int} = 2 \\ \text{2nd equ: } x\text{-int} &= 5 \text{ \& } y\text{-int} = 5\end{aligned}$$



(15) Graph the following quadratic equation and specify its vertex:

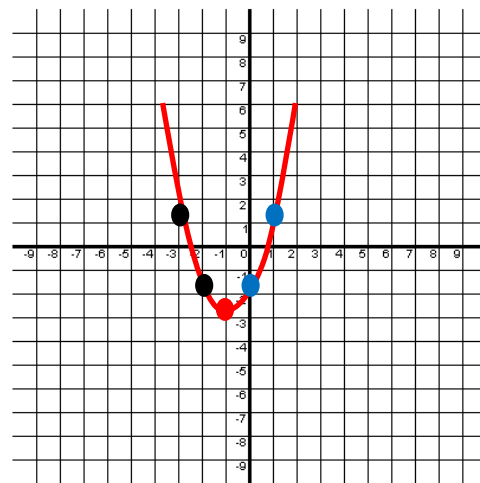
$$f(x) = x^2 + 2x - 1$$

$$\text{x-coordinate of vertex} = -\frac{b}{2a} = -\frac{2}{2} = -1$$

$$\text{y-coordinate of vertex} = (-1)^2 + 2(-1) - 1 = -2$$

Other calculated points: (0, -1), (1, 2)

And their reflected values: (-2, -1), (-3, 2)



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(16) Factor:

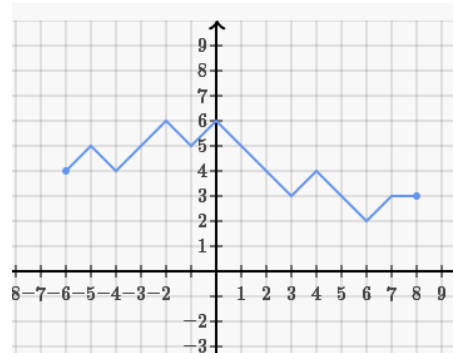
(a) $x^2 + x - 2$ $(x - 1)(x + 2)$

(b) $x^2 - 4$ $(x - 2)(x + 2)$

(c) $6x^2 - 3x - 3$
 $3(2x^2 - x - 1)$
 $3(2x + 1)(x - 1)$

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(17) Is the following graph a function? If so, give its domain and range. Is it a one-to-one correspondence?



Yes, this is a function according to the vertical line test with domain = $-6 \leq x \leq 8$ and range = $-2 \leq y \leq 6$

No, it is not a 1:1 correspondence according to the horizontal line test

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