Algebra

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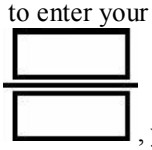
For questions followed by a numeric entry box  , you are to enter your own answer in the box. For questions followed by fraction-style numeric entry boxes  , you are to enter your answer in the form of a fraction. You are not required to reduce fractions. For example, if the answer is 1/4, you may enter 25/100 or any equivalent fraction.

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1. If $3x + 2(x + 2) = 2x + 16$, then $x =$

(A) 3
(B) 4
(C) 20/3
(D) 10
(E) 12

2. If $x \neq 0$ and $\frac{3x+7}{x} = 10$, what is the value of x?

3. If $4(-3x - 8) = 8(-x + 9)$, what is x^2?

4. If $3x + 7 - 4x + 8 = 2(-2x - 6)$, what is the value of x?

5. If $2x(4 - 6) = -2x + 12$, what is the value of x?

6. If $x \neq 0$ and $\frac{3(6-x)}{2x} = -6$, what is the value of x?

7. If $x \neq -13$ and $\frac{13}{x+13} = 1$, what is the value of x?

8. If $x \neq 2$ and $\frac{10(-3x+4)}{10-5x} = 2$, what is the value of x?

9. If $x \neq 2$ and $\frac{8-2(-4+10x)}{2-x} = 17$, what is the value of x?

10.

-5 is 7 more than $-z$.

Quantity A	**Quantity B**
z	-12

11. If $(x + 3)^2 = 225$, which of the following could be the value of $x - 1$?

(A) 13
(B) 12
(C) -12
(D) -16
(E) -19

12.

$x = 2$

Quantity A	**Quantity B**
$x^2 - 4x + 3$	1

13.

$$p = 300c^2 - c$$
$$c = 100$$

Quantity A	**Quantity B**
p	$29{,}000c$

14. If $3(7 - x) = 4(1.5)$, then $x =$

15.

$$1{,}200x + 6{,}000 = 13{,}200$$
$$12y + 60 = 132$$

Quantity A	**Quantity B**
x	y

16.

$$-(x)^3 = 64$$

Quantity A	**Quantity B**
x^4	x^5

17. If $3t^3 - 7 = 74$, what is $t^2 - t$?

(A) -3
(B) 3
(C) 6
(D) 9
(E) 18

18. If $3x + 7 - 4x + 8 = 2(-2x - 6)$, what is the value of x?

19. If $y = 4x + 10$ and $y = 7x - 5$, what is the value of y?

20. If $2h - 4k = 0$ and $k = h - 3$, what is the value of $h + k$?

21. If $x - y = 4$ and $2x + y = 5$, what is the value of x?

22. If $x + 2y = 5$ and $x - 4y = -7$, what is the value of x?

23. $4x + y + 3z = 34$
$4x + 3z = 21$

What is the value of y?

24.

Quantity A	**Quantity B**
$(x + 2)(x - 3)$	$x^2 - x - 6$

25.

Quantity A	**Quantity B**
$(2s + 1)(s + 5)$	$2s^2 + 11s + 4$

26.

$xy > 0$

Quantity A	**Quantity B**
$(2x - y)(x + 4y)$	$2x^2 + 8xy - 4y^2$

27.

$x^2 - 2x = 0$

Quantity A	**Quantity B**
x	2

28.

Quantity A	**Quantity B**
$d(d^2 - 2d + 1)$	$d(d^2 - 2d) + 1$

29.

Quantity A	**Quantity B**
$xy^2z(x^2z + yz^2 - xy^2)$	$x^3y^2z^2 + xy^3z^3 - x^2y^4z$

30.

$a = 2b = 4c$ and a, b, and c are integers.

Quantity A	**Quantity B**
$a + b$	$a + c$

31.

$k = 2m = 4n$ and k, m, and n are nonnegative integers.

Quantity A	**Quantity B**
km	kn

32.

For the positive integers a, b, c, and d, a is half of b, which is one-third of c. The value of d is triple that of c.

Quantity A	**Quantity B**
$\frac{a+b}{c}$	$\frac{a+b+c}{d}$

33. If $x^2 - y^2 = 0$ and $xy \neq 0$, which of the following MUST be true?

Indicate all such statements.

☐ $x = y$

☐ $|x| = |y|$

☐ $\frac{x^2}{y^2} = 1$

34.

$3x + 6y = 27$
$x + 2y + z = 11$

Quantity A	**Quantity B**
$z + 5$	$x + 2y - 2$

35. If $(x - y) = \sqrt{12}$ and $(x + y) = \sqrt{3}$, what is the value of $x^2 - y^2$?

(A) 3
(B) 6
(C) 9
(D) 36
(E) It cannot be determined from the information given.

36.

$a \neq b$

Quantity A	**Quantity B**
$\frac{a-b}{b-a}$	1

37.

$a = \frac{b}{2}$

$c = 3b$

Quantity A	**Quantity B**
a	c

38. If $xy \neq 0$ and $x \neq -y$, $\frac{x^{36} - y^{36}}{\left(x^{18} + y^{18}\right)\left(x^9 + y^9\right)} =$

(A) 1
(B) $x^2 - y^2$
(C) $x^9 - y^9$

(D) $x^{18} - y^{18}$

(E) $\dfrac{1}{x^9 - y^9}$

39. If $x \neq -y$, $\dfrac{x^2 + 2xy + y^2}{2(x+y)^2} =$

(A) 1
(B) 1/2
(C) $\dfrac{1}{x+y}$
(D) xy
(E) $2xy$

40. If $ab \neq 0$, $\dfrac{a^8 - b^8}{(a^4 + b^4)(a^2 + b^2)} =$

(A) 1
(B) $a - b$
(C) $(a + b)(a - b)$
(D) $(a^2 + b^2)(a^2 - b^2)$
(E) $\dfrac{a-b}{a+b}$

41.

$x > y$
$xy \neq 0$

Quantity A	**Quantity B**
$\dfrac{x^2}{y + \dfrac{1}{y}}$	$\dfrac{y^2}{x + \dfrac{1}{x}}$

42. If $x + y = -3$ and $x^2 + y^2 = 12$, what is the value of $2xy$?

43. If $x - y = 1/2$ and $x^2 - y^2 = 3$, what is the value of $x + y$?

44. If $x^2 - 2xy = 84$ and $x - y = -10$, what is the value of $|y|$?

45. $(x - 2)^2 + (x - 1)^2 + x^2 + (x + 1)^2 + (x + 2)^2 =$

(A) $5x^2$
(B) $5x^2 + 10$
(C) $x^2 + 10$
(D) $5x^2 + 6x + 10$
(E) $5x^2 - 6x + 10$

46. If $a = (x + y)^2$ and $b = x^2 + y^2$ and $xy > 0$, which of the following must be true?

Indicate <u>all</u> such statements.

☐ $a = b$
☐ $a > b$
☐ a is positive

47. a is directly proportional to b. If $a = 8$ when $b = 2$, what is a when $b = 4$?

(A) 10
(B) 16
(C) 32
(D) 64
(E) 128

48. a is inversely proportional to b. If $a = 16$ when $b = 1$, what is b when $a = 8$?

(A) -2
(B) -1
(C) 2
(D) 4
(E) 8

49. The time it takes to erect a bonfire is inversely proportional to the number of students doing the work. If it takes 20 students 1.5 hours to do the job, how long will it take 35 students to do the job, to the nearest minute?

(A) 51
(B) 52
(C) 53
(D) 54
(E) 55

50.

$3a + 2b = 20$ and $2a + 3b = 5$

Quantity A	**Quantity B**
$a + b$	a

51.

$m + 2n = 10$ and m is 50% of n

Quantity A	**Quantity B**
m^2	n

52.

For the integers a, b, and c, the sum of a and b is 75% of c.

Quantity A	**Quantity B**
$(3/4)(a + b)$	$(4/3)(c)$

53. If $2a = 4b = 8c = 10$, then $64abc =$

(A) 64,000
(B) 16,000
(C) 8,000
(D) 4,000
(E) 1,000

54. If $4m^2 + 6n^3 - 9 = 16$, what is the value of $2m^2 + 3n^3$?

55. If $a + b = 8$, $b + c = 11$, and $a + c = 5$, what is the value of $a + b + c$?

Inequalities and Absolute Values

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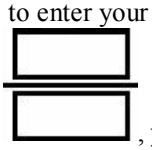
For questions followed by a numeric entry box  , you are to enter your own answer in the box. For questions followed by fraction-style numeric entry boxes  , you are to enter your answer in the form of a fraction. You are not required to reduce fractions. For example, if the answer is 1/4, you may enter 25/100 or any equivalent fraction.
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1.

$$|3x - 18| = 9$$

Quantity A	**Quantity B**
x	6

2. If $2z + 4 \geq -18$, which of the following must be true?

(A) $z \leq -11$
(B) $z \leq 11$
(C) $z \geq -11$
(D) $z \geq -7$
(E) $z \geq 7$

3.

$$7y - 3 \leq 4y + 9$$

Quantity A	**Quantity B**
y	4

4.

$$d + \frac{3}{2} < 8$$

Quantity A	**Quantity B**
$2d$	13

5.

$$\frac{4x}{7} \leq 15 + x$$

$$2y - 1.5 > 7$$

Quantity A	**Quantity B**
x	y

6.

$$3|x - 4| = 16$$

Quantity A	**Quantity B**
x	$\frac{28}{3}$

7. If $b \neq 0$ and $\frac{a}{b} > 0$, then which of the following must be true?

- ☐ $a > b$
- ☐ $b > 0$
- ☐ $ab > 0$

8. If $6 < 2x - 4 < 12$, which of the following could be a value of x?

(A) 4
(B) 5
(C) 7
(D) 8
(E) 9

9. If $y < 0$ and $4x > y$, which of the following could be equal to $\frac{x}{y}$?

(A) 0
(B) $\frac{1}{4}$
(C) $\frac{1}{2}$
(D) 1
(E) 4

10.

$|x + 6| = 3$
$|2y| = 6$

Quantity A	**Quantity B**
The greatest possible value for x	The least possible value for y

11. If $|4y + 2| = 18$, which of the following could be the value of y^2?

Indicate two such values.

- ☐ 2
- ☐ 5
- ☐ 16
- ☐ 25
- ☐ 36

12.

$3(x - 7) \geq 9$
$0.25y - 3 \leq 1$

Quantity A	**Quantity B**
x	y

13. If $|1 - x| = 6$ and $|2y - 6| = 10$, which of the following could be the value of xy?

Indicate all such values.

- ☐ -40
- ☐ -14
- ☐ -10
- ☐ 56

14. If $2(x - 1)^3 + 3 \leq 19$, then the value of x must be

(A) greater than or equal to 3
(B) less than or equal to 3

(C) greater than or equal to -3
(D) less than or equal to -3
(E) less than -3 or greater than 3

15. If $3P < 51$ and $5P > 75$, what is the value of the integer P?

(A) 15
(B) 16
(C) 24
(D) 25
(E) 26

16. A bicycle wheel has spokes that go from a center point in the hub to equally spaced points on the rim of the wheel. If there are fewer than six spokes, what is the smallest possible angle between any two spokes?

(A) 18 degrees
(B) 30 degrees
(C) 40 degrees
(D) 60 degrees
(E) 72 degrees

17.

$|-x| \geq 6$

$xy^2 < 0$ where y is an integer.

Quantity A	**Quantity B**
x	-4

18. If $\frac{|x+4|}{2} > 5$ and $x < 0$, which of the following could be the value of x?

Indicate all such values.

☐ -6
☐ -14
☐ -18

19.

$|x^3| < 64$

Quantity A	**Quantity B**
$-x$	$-\|x\|$

20. If $|0.1x - 3| \geq 1$, then x could be which of the following values?

Indicate all such values.

☐ 10
☐ 20
☐ 30
☐ 40
☐ 50
☐ 60

21. If $|3x + 7| \geq 2x + 12$, then

(A) $x \leq \frac{-19}{5}$
(B) $x \geq \frac{-19}{5}$
(C) $x \geq 5$
(D) $x \leq \frac{-19}{5}$ or $x \geq 5$
(E) $\frac{-19}{5} \leq x \leq 5$

22.

$|3 + 3x| < -2x$

Quantity A	**Quantity B**
$\|x\|$	4

23. If $|y| \leq -4x$ and $|3x - 4| = 2x + 6$, what is the value of x?

(A) -3
(B) -1/3
(C) -2/5
(D) 1/3
(E) 10

24.

x is an integer such that $-x|x| > 4$.

Quantity A	**Quantity B**
x	2

25.

$|x| < 1$ and $y > 0$

Quantity A	**Quantity B**
$\|x\| + y$	xy

26.

x and y are positive numbers such that $x + y + z < 1$ and $xy = 1$

Quantity A	**Quantity B**
z	-1

27.

$|x| > |y|$ and $x + y > 0$

Quantity A	**Quantity B**
y	x

28.

x and y are integers such that $|x|(y) + 9 < 0$ and $|y| \leq 1$.

Quantity A	**Quantity B**
x	-9

29. If $x + y + z = 0$ and $z = 8$, which of the following must be true?

(A) $x < 0$
(B) $y < 0$
(C) $x - y < 0$
(D) $z - y > 0$
(E) $x + y < 0$

30.

$p + |k| > |p| + k$

Quantity A	**Quantity B**
p	k

31.

$|x| + |y| > |x + z|$

Quantity A	**Quantity B**
y	z

32.

$b \neq 0$

$$\frac{|a|}{b} > 1$$

$a + b < 0$

Quantity A	**Quantity B**
a	0

33. If $\frac{a}{b} > \frac{c}{d}$, which of the following statements must be true?

Indicate <u>all</u> such statements.

- ☐ $\frac{a}{b} - \frac{c}{d} > 0$
- ☐ $ad < bc$
- ☐ $ad > bc$

34. If $f^2g < 0$, which of the following must be true?

(A) $f < 0$
(B) $g < 0$
(C) $fg < 0$
(D) $fg > 0$
(E) $f^2 < 0$

35. $\sqrt{96} < x\sqrt{6}$ and $\frac{x}{\sqrt{6}} < \sqrt{6}$. If x is an integer, which of the following is the value of x?

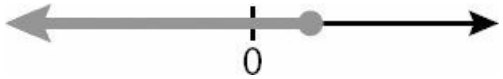
(A) 2
(B) 3
(C) 4
(D) 5
(E) 6

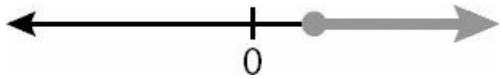
36.

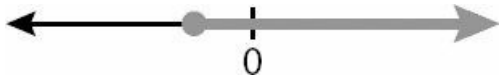
$|x|y > x|y|$

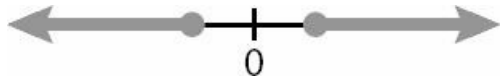
Quantity A	**Quantity B**
$(x + y)^2$	$(x - y)^2$

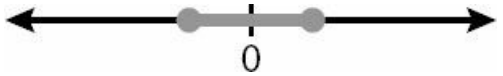
37. Which of the following could be the graph of all values of x that satisfy the inequality $4 - 11x \geq \frac{-2x + 3}{2}$?

(A) 

(B) 

(C) 

(D) 

(E) 

38. If $|x^2 - 6| = x$, which of the following could be the value of x?

(A) -2
(B) 0
(C) 1
(D) 3
(E) 5

39.

$$-1 < a < 0 < |a| < b < 1$$

Quantity A	**Quantity B**
$\left(\frac{a^2\sqrt{b}}{\sqrt{a}}\right)^2$	$\frac{ab^5}{\left(\sqrt{b}\right)^4}$

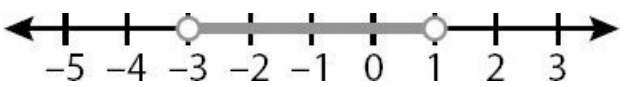
40.

$$x > |y| > z$$

Quantity A	**Quantity B**
$x + y$	$\lvert y\rvert + z$

41. The integers k, l, and m are consecutive even integers between 23 and 33. Which of the following could be the average of k, l, and m?

(A) 24
(B) 25
(C) 25.5
(D) 28
(E) 32

42. 

The number line above represents which of the following inequalities?

(A) $x < 1$
(B) $-6 < 2x < 2$
(C) $-9 < 3x < 6$
(D) $1 < 2x < 3$
(E) $x > -3$

43. For a jambalaya cook-off, there will be x judges sitting in a single row of x chairs. If x is greater than 3 but no more than 6, which of the following could be the number of possible seating arrangements for the judges?

Indicate <u>two</u> such numbers.

☐ 6
☐ 25
☐ 120
☐ 500
☐ 720

44. If $b \neq 0$, which of the following inequalities must be equivalent to $\frac{a}{-3b} < c$?

Indicate <u>all</u> such inequalities.

☐ $\frac{a}{b} > -3c$
☐ $\frac{a}{-3} < bc$
☐ $a > -3bc$

45.

$$a - b > a + b + c$$

Quantity A	**Quantity B**
$2b + c$	$b + c$

46.

$$|x + y| = 10$$
$$x > 0$$
$$z < y - x$$

Quantity A	**Quantity B**
z	10

47.

$$0 < a < \frac{b}{2} < 9$$

Quantity A	**Quantity B**
$9 - a$	$\frac{b}{2} - a$

48.

For all values of the integer p such that $1.9 < |p| < 5.3$, the function $f(p) = p^2$

Quantity A	**Quantity B**
$f(p)$ for the greatest value of p	$f(p)$ for the least value of p

49. If $\left|\frac{a}{b}\right|$ and $\left|\frac{x}{y}\right|$ are reciprocals and $\frac{a}{b}\left(\frac{x}{y}\right) < 0$ which of the following must be true?

(A) $ab < 0$
(B) $\frac{a}{b}\left(\frac{x}{y}\right) < -1$
(C) $\frac{a}{b} < 1$
(D) $\frac{a}{b} = -\frac{y}{x}$
(E) $\frac{y}{x} > \frac{a}{b}$

50. If $mn < 0$ and $\frac{k}{m} + \frac{l}{n} < mn$, which of the following must be true?

(A) $km + ln < (mn)^2$
(B) $kn + lm < 1$
(C) $kn + lm > (mn)^2$
(D) $k + l > mn$
(E) $kn > -lm$

51. Which of the following inequalities is equivalent to $|m + 2| < 3$?

(A) $m < 5$
(B) $m < 1$
(C) $-5 < m < 5$

(D) $m > -1$
(E) $-5 < m < 1$

52. If the reciprocal of the negative integer X is greater than the sum of Y and Z, then which of the following must be true?

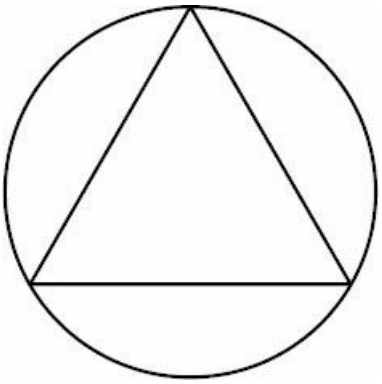
(A) $X > Y + Z$
(B) Y and Z are positive
(C) $1 > X(Y + Z)$
(D) $1 < XY + XZ$
(E) $\frac{1}{X} > Z - Y$

53. If $m + n - 2p < p + n + 4m$, which of the following inequalities must be true?

(A) $5m < 3p$
(B) $p > -m$
(C) $3m > 3p + 2n$
(D) $p > 2$
(E) $n < p$

54. If u and $-3v$ are greater than 0 and $\sqrt{u} < \sqrt{-3v}$, which of the following cannot be true?

(A) $u/3 < -v$
(B) $u/v > -3$
(C) $\sqrt{\frac{u}{-v}} < \sqrt{3}$
(D) $u + 3v > 0$
(E) $u < -3v$



55. In the figure above, an equilateral triangle is inscribed in a circle. If the arc bounded by adjacent corners of the triangle is between 4π and 6π long, which of the following could be the diameter of the circle?

(A) 6.5
(B) 9
(C) 11.9
(D) 15
(E) 23.5

Algebra Answer Key

Question	Answer	Question	Answer
1	B	45	B
2	1	46	II & III only
3	676	47	B
4	-9	48	C
5	-6	49	A
6	-2	50	B
7	0	51	C
8	1	52	D
9	-6	53	E
10	A	54	12.5
11	E	55	12
12	B		
13	A		
14	5		
15	C		
16	A		
17	C		
18	-9		
19	30		
20	9		
21	3		
22	1		
23	13		
24	C		
25	A		
26	B		
27	D		
28	D		
29	C		
30	D		
31	D		
32	C		
33	II & III only		
34	C		
35	B		
36	B		
37	D		
38	C		
39	B		
40	C		
41	D		
42	-3		
43	6		
44	4		

Inequalities and Absolute Value Answer Key

Question	Answer	Question	Answer
1	D	45	D
2	C	46	B
3	D	47	A
4	B	48	C
5	D	49	D
6	D	50	C
7	III only	51	E
8	C	52	D
9	A	53	B
10	C	54	D
11	16 ó 25	55	D
12	D		
13	-40,-14, and 56 only		
14	B		
15	B		
16	E		
17	B		
18	III only		
19	D		
20	10, 20, 40, 50, 60 only		
21	D		
22	B		
23	C		
24	B		
25	A		
26	B		
27	B		
28	D		
29	E		
30	A		
31	D		
32	B		
33	I only		
34	B		
35	D		
36	B		
37	A		
38	D		
39	A		
40	D		
41	D		
42	B		
43	120 and 720 only		
44	I only		