1. $|8-3|-|3-8|=?$

A. -10
B. 10
C. 0
D. -6
E. -5

2. What is the value of $|x-y|+(x-2y)^2$ when $x=2$ and $y=4$?

A. 34
B. 38
C. 2
D. -4
E. 4

3. If $x \geq 9$, then $|9-x| = ?$

A. $9-x$
B. $x-9$
C. $x+9$
D. 0
E. $-9-x$

4. $-4|-13+2|=?$

A. 44
B. -15
C. -60
D. 60
E. -44

5. If $|x+7|=32$ what are all the possible values for x?

A. 25 and -25
B. 39 and 25
C. -7 and 7
D. 25 and -7
E. 25 and -39

6. If $|x-3|=14$ what are all the possible values for x?

A. 17 and -11
B. -17 and -11
C. 17 and 11
D. 17 and -17
E. 3 and -3

7. If $|x-7|=|-2|$ how many different values are possible for x?

A. 0
B. 1
C. 2
D. 4
E. Infinitely many

8. How many real solutions are possible for m in the equation $|3m+5|=-4$?

A. 0
B. 1
C. 2
D. 4
E. Infinitely many

9. $-6|-7+8|=?$

A. -6
B. -5
C. -90
D. 90
E. 6

10. For all $n<0$, $\left|-n^5\right|-\left(-\left|2\right|^3\right)=?$

A. n^5+6
B. $-n^5+8$
C. n^5-8
D. n^5+8
E. $-n^5+6$

11. What are all the real solutions to the equation $|x^2|+3|x|-10=0$?

A. ± 2
B. ± 5
C. -5 and 2
D. -5 and -2
E. ± 2 and ± 5

12. If $a>b$ then $|a-b|=?$

A. $\sqrt{a-b}$
B. $-(a-b)$
C. $-(a+b)$
D. $a-b$
E. 0

13. For all non-zero real numbers a and b such that $\left|\frac{a}{b}\right|=\left|\frac{b}{a}\right|$, which of the following COULD be TRUE?

I. $a=-\sqrt{b^2}$
II. $a-b=2$
III. $ab=-ab$

A. I only
B. II only
C. I & II only
D. I & III only
E. I, II, and III

14. At a newsstand, it costs n dollars for a newspaper, and m dollars for a magazine. The difference between the cost of 15 newspapers and 18 magazines is $\$48$. Which of the following equations represents the relationship between n and m?

A. $\frac{15n}{18m} = 48$
B. $270nm = 48$
C. $|15n - 18m| = 48$
D. $|15n + 18m| = 48$
E. $18n - 15m = 48$

15. For all real values of x, y, and all values of a such that $a \geq 0$, $|x| = |y| = -a$ for how many (x, y) solutions?

A. 0
B. 1
C. 2
D. 3
E. 4

16. For how many pairs (a, b) is the following equation true?

$$\left|\frac{a}{b} - \frac{b}{a}\right| = \left|\frac{b}{a} - \frac{a}{b}\right|$$

A. 0
B. 1
C. 2
D. 4
E. Infinitely many

17. If $x \geq 5$, then $|x - 5| = ?$

A. 0
B. $x - 5$
C. $x + 5$
D. $-x + 5$
E. $-x - 5$

18. If $x - |x| = 0$ then x is:

A. always negative
B. sometimes positive
C. always positive
D. always zero
E. sometimes negative

19. If $|x| = -x$, $|-y| = y$, and $xy \neq 0$, which of the following must be negative?

A. x^y
B. y^x
C. $x - y$
D. $x + y$
E. $y - x$

20. If $|a| - b = |b| - a$ and $a > 0$, which of the following statements must be true?

A. $a + b = 0$
B. $ab < 0$
C. $a = b$
D. $a = 0$ or $b = 0$, but not both
E. $a = -b$

21. If $|x| > x$, then which of the following must be true?

A. $-x \leq x$
B. $x = 0$
C. $x^3 < 0$
D. $x \geq 0$
E. $2x > x$

22. Which of the following equations could be used to represent "the distance between x and n" if there are two solutions for x, if n is the mean of the two solutions, and the two solutions are 10 units apart on the number line?

A. $|x + n| = 10$
B. $|x - n| = 10$
C. $|x - n| = 5$
D. $|x + n| = 5$
E. $|x - 5| = n$

23. On an amusement park ride, riders must be between 42 and 72 inches in order to ride. Which of the following equations could be used to represent the possible heights, h, of a potential rider, in inches?

A. $|h - 57| \geq 15$
B. $|h - 57| \leq 15$
C. $|h - 72| \leq 30$
D. $|h - 42| \leq 30$
E. $|h + 42| \leq 30$

24. At an apparel factory, a pair of medium shorts has an average waist circumference of 29 inches. These shorts must not vary from the average waist circumference by more than $.25$ inch to pass quality control inspections. Which of the following equations could be used to represent the range of possible waist circumferences, c, that would pass quality control inspections for a pair of medium shorts?

A. $|29-c|\le 0.25$

B. $|29-c|\ge 0.25$

C. $|c-0.25|\ge 29$

D. $\dfrac{c}{29}\le 0.25$

E. $|29+c|\ge 0.25$

25. The solution to which of the following equations is the set of real numbers that are 3 units away from 7?

A. $|x-7|=3$

B. $|x+3|=7$

C. $|x-3|=7$

D. $|x+7|=3$

E. $|x-7|=-3$

26. Which irrational number is the solution to $|x^2-18|-7=0$?

A. $\sqrt{11}$

B. $\sqrt{5}$

C. 2.5

D. $3\sqrt{2}$

E. $4\sqrt{2}$

27. Which of the following expressions, if any, are equal to each other for all real numbers x?

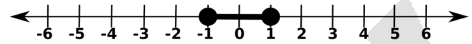
I. $-\sqrt{(-x)^2}$

II. $|-x|^3$

III. $-|-x|$

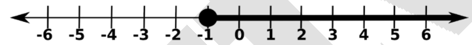
A. I and II only
B. II and III only
C. I and III only
D. I, II, and III
E. None of the above

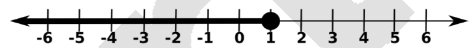
28. Which of the following graphs represents the solution set of the inequality $|x|\le 1$?

A. 

B. 

C. 

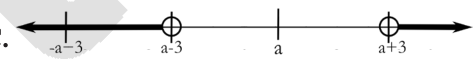
D. 

E. 

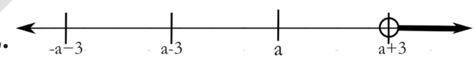
29. Whenever $a>0$, which of the following real number line graphs represents the solution for x to the inequality $|x-a|>3$?

A. 

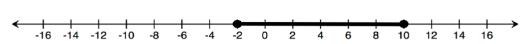
B. 

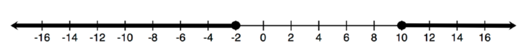
C. 

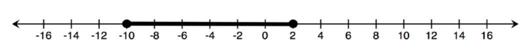
D. 

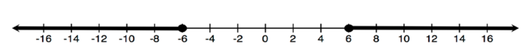
E. 

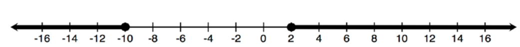
30. Which of the following is the solution set for $-2|x+4|\ge -12$?

A. 

B. 

C. 

D. 

E. 

ANSWER KEY

1. C	2. B	3. B	4. E	5. E	6. A	7. C	8. A	9. A	10. D	11. A	12. D	13. C	14. C
15. B	16. E	17. B	18. B	19. C	20. C	21. C	22. C	23. B	24. A	25. A	26. A	27. C	28. A
29. C	30. C												

ANSWER EXPLANATIONS

1. **C.** $|8-3|-|3-8|=|5|-|-5|\rightarrow 5-5=0$

2. **B.** Plugging in $x=2$ and $y=4$, we get $|2-4|+\left(2-2(4)\right)^2\rightarrow|-2|+(2-8)^2\rightarrow 2+(-6)^2=2+36\rightarrow 38.$

3. **B.** $|9-x|$ is the positive difference between x and 9. $x-9$ is also equal to the positive difference between x and 9 because $x\geq 9$. Notice that $9-x$ will yield a negative answer and will not be equivalent to $|9-x|$. You can also make up numbers and test them to solve this problem.

4. **E.** $-4|-13+2|=-4|-11|\rightarrow -4(11)\rightarrow -44$

5. **E.** $|x+7|=32$ means that $x+7=32$ or $x+7=-32$. Solving these two inequalities separately, we get $x=32-7\rightarrow 25$ or $x=-32-7\rightarrow -39$. So, the possible values for x are 25 and -39.

6. **A.** $|x-3|=14$ means that $x-3=14$ or $x-3=-14$. Solving these two inequalities separately, we get $x=14+3\rightarrow 17$ or $x=-14+3\rightarrow -11$. So, the possible values for x are 17 and -11.

7. **C.** $|x-7|=|-2|$ means $|x-7|=2$. So, $x-7=2$. or $x-7=-2$. Solving these two inequalities separately, we get $x=7+29$ or $x=7-2\rightarrow 5$. So, there are two possible solutions.

8. **A.** The absolute value of something is always positive, so there is no solution for $|3m+5|=-4$ because -4 is negative.

9. **A.** $-6|-7+8|=-6|1|\rightarrow -6$.

10. **D.** $|-n^5|-\left(-|2|^3\right)=n^5-(-8)\rightarrow n^5+8.$

11. **A.** We first solve this without the absolute values, or let $|x|=n$ and solve $n^2+3n-10=0$. This factors to be $(n+5)(n-2)$. So, the solutions that make this equal to zero are $n=-5$ and $n=2$. Since the solution for n (which equals $|x|$) must be positive, $|x|$ must equal 2 , so $x=\pm 2.$

12. **D.** If $a>b$ then $a-b$ is positive. So, $|a-b|=a-b$.

13. **C.** If $\left|\frac{a}{b}\right|=\left|\frac{b}{a}\right|$ then multiplying both sides by $|a||b|$, we get $|a^2|=|b^2|$. Since all squares are positive, $a^2=b^2$. Taking the square root on both sides, we get $a=\pm\sqrt{b^2}$. So, I could be true. For II, we have $a-b=2\rightarrow a=b+2$ and plugging in $a=b+2$ to $\left|\frac{a}{b}\right|=\left|\frac{b}{a}\right|$ we get $\left|\frac{b+2}{b}\right|=\left|\frac{b}{b+2}\right|$. This statement could be true if $b=-1\rightarrow\left|\frac{-1+2}{-1}\right|=\left|\frac{-1}{-1+2}\right|\rightarrow\left|\frac{1}{-1}\right|=\left|-\frac{1}{1}\right|\rightarrow 1=1$. For III, we have $ab=-ab\rightarrow a=-a$ or $b=-b$. This is only true if a or b equals zero. However, it is given that a and b are non-zero, so III cannot be true.

14. **C.** The cost of 15 newspapers can be represented by $15n$ and the cost of 18 magazines can be represented by $18m$. The difference between these two prices is 48, but we don't know if $15n$ is greater or if $18m$ is greater. So, $|15n-18m|=48$.

15. **B.** $|x|$ and $|y|$ are always positive or zero, so $|x|=|y|=-a$ is only true when x,y and a are zero. $|0|=|0|=-0=0$. There is only one solution.

16. E. Because $|x|=|-x|$, we can manipulate one side of the expression by multiplying it by -1. This gives us $\left|\frac{a}{b}-\frac{b}{a}\right|=\left|(-1)\left(\frac{b}{a}-\frac{a}{b}\right)\right|$ and therefore that $\left|\frac{a}{b}-\frac{b}{a}\right|=\left|\frac{a}{b}-\frac{b}{a}\right|$. This is true for all values of a and b given that neither of them are 0, so there are infinitely many solutions.

17. B. If $x \ge 5$ then $x-5$ is positive. So, $|x-5|=x-5$.

18. B. If $x-|x|=0$ then $x=|x|$. So, $x \ge 0$. Since 0 is not positive, x is only sometimes positive.

19. C. If $|x|=-x$ then x must be negative because any absolute value is positive, and the negative of a negative number is positive. Likewise, $|-y|=y$ implies that y is positive. So, the only answer choice that gives us a negative value is $x-y$ because it is a negative number minus a positive number. Note that all other answer choices may yield negative values but may also yield positive values. $x-y$ is the only choice that guarantees a negative answer.

20. C. If a is positive, then $|a|=a$. So, we can rewrite the equation as $a-b=|b|-a$. Adding a on both sides and adding b on both sides, we get $2a=b|b|$. Since we know $2a$ is positive and $|b|$ has to be positive because it is an absolute value, we know that b also has to be positive in order for the statement to be true. This means that $2a=2b \rightarrow a=b$.

21. C. If $|x|>x$, then that means x is negative. Hence, x^3 is also negative.

22. C. The distance between x and n is $|x-n|=d$. If the average of the two solutions is n, then their sum is $2n$. The solutions are, $x-n=d$ or $x-n=-d \rightarrow x=n+d$ or $xn-d$. Their sum is verified to equal $2n$ because $n+d+n-d=2n$. Now, we are given that the two solutions are 10 units apart, so $n+d-(n-d)=10 \rightarrow 2d=10 \rightarrow d=5$. So, the distance between x and n can be expressed as $|x-n|=5$.

23. B. The heights must not be over 72 and not be below 42, so the heights can be represented as within the range of the mean of the heights $\pm$ half the range of the heights. This can be expressed as $h \le \frac{72+42}{2} \pm \frac{72-42}{2} \le \frac{114}{2} \pm \frac{30}{2} \le 57 \pm 15$. This is re-written as $h-57 \le \pm 15$ or $|h-57| \le 15$. We can also average $72+42$ to get 114, divide by 2 to get 57, our mean or "ideal" and remember that this mean or ideal is the number subtracted from the h. The difference between $72-15$ is 15, which then goes on the right of the inequality. We ideally want 57, but can be up to 15 away from it.

24. A. The range of waist circumferences that will pass the inspections is within the range of the average 29 inches $\pm\frac{1}{4}$ inches. So, $c-29 \le \pm\frac{1}{4}$. This means $|c-29| \le \frac{1}{4}$. This is equivalent to $|29-c| \le \frac{1}{4}$.

25. A. The set of numbers that are 3 units away from 7 can be expressed with the expression $x=7\pm 3$. Subtracting 7 on both sides, we have $x-7=\pm 3$. This can be written with absolute values as $|x-7|=3$.

26. A. Adding 7 on both sides of the equation, we get $|x^2-18|=7$ so $x^2-18=7$ or $x^2-18=-7$. Adding 18 on both sides of both equations, we get $x^2=23$ or $x^2=11$. So, $x=\pm\sqrt{23}$ or $\pm\sqrt{11}$. $\pm\sqrt{11}$ is the only solution for x that is in the answer choices.

27. C. I. simplifies to $-\sqrt{(-x)^2}=-\sqrt{x^2} \rightarrow -x$. II. Simplifies to $|-x|^3=x^3$, and III. Simplifies to $-|-x|=-x$. So, only expressions I and III are equal for all x.

28. A. $|x| \le 1$ means $-1 \le x \le 1$, which is represented by the graph in answer choice A.

29. C. $|x-a|>3$ means that $-3>x-a>3$, which when we add a to all three parts becomes: $-3+a>x>3+a$ (this can also be written as $x<a+3$ and $x>a+3$). The graph in answer choice C correctly reflects this.

30. C. First isolate the absolute value sign by dividing both side by -2 to get $|x+4| \le 6$. Now we can treat it like a regular inequality and say that $-6 \le x+4 \le 6$. When we subtract 4 from all three parts, we get $-10 \le x \le 2$, which is the same as $x \le 2$ and $x \ge -10$, which is shown in answer C.