SIMPLIFYING EXPRESSIONS WITH ABSOLUTE VALUES

1. Write down the definition of $|x|$.
   Hence
   a) if $x > 0$, simplify $|x| + 3$;
   b) if $x < 0$, simplify $|x| + 3$;
   c) if $x > 5$, simplify $|x| + 3$.

2. Write down the definition of $|x + 2|$.
   Hence
   a) if $x > 3$, simplify $|x + 2| + 1$;
   b) if $x < -2$, simplify $|x + 2| + 1$;
   c) if $0 < x < 2$, simplify $|x + 2| + 1$.

3. Write down the definition of $|x - 5|$.
   Hence
   a) if $x > 10$, simplify $|x - 5| + x$;
   b) if $x < 3$, simplify $|x - 5| + x$.

4. a) If $x \geq 5$, simplify $|x + 2| + |x - 5|$.
   b) If $x < -2$, simplify $|x + 2| + |x - 5|$.
   c) If $-2 < x < 5$, simplify $|x + 2| + |x - 5|$.

5. If $x > 0$, simplify $|x| + |x + 1|$.

6. If $x < 0$, simplify $|x| + |x - 1|$.

7. If $x > 6$, simplify $|x| + |x - 2|$.

8. If $x < 0$, simplify $|x| + |x - 2|$.

9. If $0 < x < 1$, simplify $|x| + |x - 2|$.

10. If $x < 3$, simplify $|x - 3| + 2x$.

11. If $x > 3$, simplify $|x - 2| - x$.

12. If $-2 \leq x < 0$, simplify $|2x - 1| + |x + 3|$.

Answers:

1. a) $x + 3$
   b) $3 - x$
   c) $x + 3$
2. a) $x + 3$
   b) $-1 - x$
   c) $x + 3$
3. a) $2x - 5$
   b) 5
4. a) $2x - 3$
   b) $-2x + 3$
   c) 7
5. $2x + 1$
6. $1 - 2x$
7. $2x - 2$
8. $2 - 2x$
9. 2
10. $x + 3$
11. -2
12. $4 - x$

EXERCISE 4.4

Solve these equations:

1. $|x| = 6$
2. $|4x| = 20$
3. $|x - 5| = 8$
4. $|2x - 3| = 17$
5. $|5x + 2| = 12$
6. $|2x + 6| = |x + 10|$
7. $|3x - 12| = 0$
8. $|2x - 5| = |x + 2|$
9. $|7x - 4| = |3x + 16|$
10. $|9x + 2| = |3x - 4|$
11. $|2x + 1| = |x - 2|$
12. $2|x + 8| = 3|x + 5|$
13. $5|x - 7| = |9x + 1|$
14. $6|x + 3| - 2|x + 1| = 0$
15. $|7x - 3| = 4|x + 6|$

Solve the following equations and check the validity of each solution.

16. $|3x + 1| = 2x + 4$
17. $|4x - 1| = 2x + 7$
18. $|2x| = 9 - x$
19. $|2x + 5| = 3x + 9$
20. $|6x - 5| = 5x + 27$
21. $|4 - 2x| = x - 2$

1. $x = \pm 6$
3. $x = 13$ or -3
5. $x = 2$ or $-2\frac{4}{5}$
7. $x = 4$
9. $x = 5$ or $-1\frac{1}{5}$
11. $x = \frac{1}{3}$ or -3
13. $x = -9$ or $2\frac{3}{7}$
15. $x = 9$ or $-1\frac{10}{11}$
17. $x = -1$ or 4
19. $x = -2\frac{4}{5}$
21. $x = 2$

2. $x = \pm 5$
4. $x = 10$ or -7
6. $x = 4$ or $-5\frac{1}{3}$
8. $x = 7$ or 1
10. $x = -1$ or $\frac{1}{6}$
12. $x = 1$ or $-6\frac{1}{5}$
14. $x = -4$ or $-2\frac{1}{2}$
16. $x = -1$ or 3
18. $x = 3$ or -9
20. $x = 32$ or -2