School-Based Exercise (S.B.E)

Chapter 9
Linear Equations in Two Unknowns

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$C = 2\pi r$

$A = \pi r^2$

$\pi r^2 h$

$60°$

$V = \frac{1}{3}\pi r^2 h$

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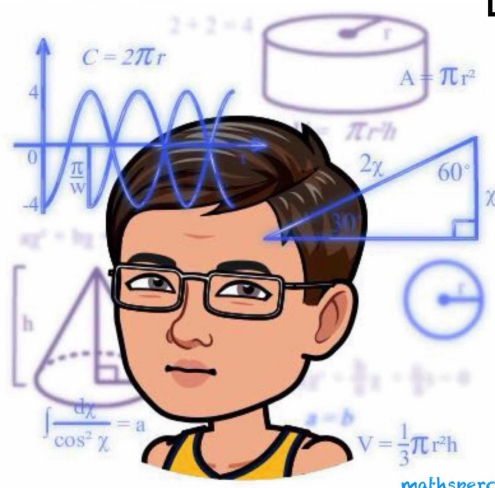
Basic Concepts of Linear Equations in Two Unknowns

An ordered pair (a, b) is a solution of a linear equation in two unknowns x and y if the pair of values '$x = a$' and '$y = b$' satisfies the equation.

The solutions of a linear equation in two unknowns can be represented by points on a rectangular coordinate plane. A straight line can be drawn passing through the points. The straight line is called the graph of the equation.
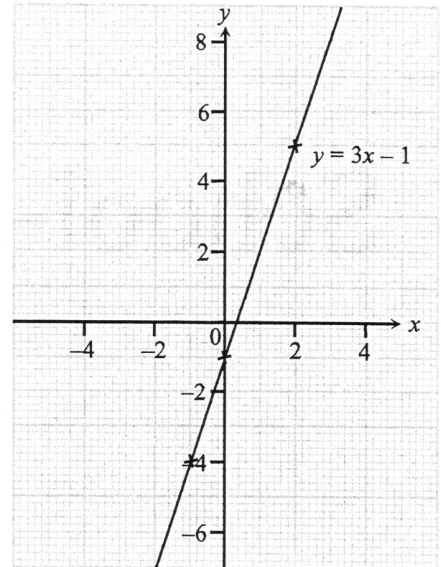
e.g.

Draw the graph of the equation $y = 3x - 1$.

Solution

$y = 3x - 1$

x	−1	0	2
y	−4	−1	5

The graph of $y = 3x - 1$ is shown below.

Exercise 9A

1. In each of the following, complete the table such that the ordered pairs (x, y) satisfy the given equation.

    (a) $y = 6x + 4$

x	−1	0	1	2
y				

    (b) $y = 1 - 4x$

x	−2	0	2	3
y				

2. In each of the following, complete the table such that the ordered pairs (x, y) satisfy the given equation.

    (a) $y = -(x - 2)$

x	−1	0	1	2
y				

    (b) $y = 2(1 - x)$

x	−2	0	2	3
y				

3. In each of the following, complete the table such that the ordered pairs (x, y) satisfy the given equation.

    (a) $y = \dfrac{x}{3} + 4$

x	−3	0	3	6
y				

    (b) $y = \dfrac{x - 5}{2}$

 | x | −3 | −1 | 0 | 3 |
    |-----|-----|-----|-----|-----|
    | y | | | | |

4. In each of the following, check whether the given ordered pair is a solution of the equation $y = 2x - 1$.

    (a) $(2, 3)$

    (b) $(-2, -3)$

5. In each of the following, check whether the given ordered pair is a solution of the equation $x - 2y = 3$.
   (a) $(3, 3)$ **(b)** $(-3, 0)$

6. In each of the following, check whether the given ordered pair is a solution of the equation $x + 2y = 4$.
   (a) $(0, 2)$ **(b)** $(-2, 4)$

7. In each of the following, check whether the given ordered pair is a solution of the equation $3x + y = -1$.
   (a) $(2, -5)$ **(b)** $(-1, 2)$

8. In each of the following, determine whether the point lies on the graph of the equation $x + 4y = 3$.
   (a) $A(7, -1)$ **(b)** $B(0, 1)$

9. In each of the following, determine whether the point lies on the graph of the equation $y = 6x - 1$.
   (a) $A(1, 6)$ **(b)** $B(-1, -7)$

10. Determine whether the graph of the equation $2x + 4y = 1$ passes through each of the following points.
    (a) $A(-4, 2)$ **(b)** $B(5, -2)$

11. Determine whether the graph of the equation $5x - 3y + 1 = 0$ passes through each of the following points.
    (a) $A(-2, 3)$ **(b)** $B(1, 2)$

    (i) Does the graph cut the y-axis at $(0, 7)$?
    (ii) The point $C(-2, c)$ lies on the graph. What is the value of c?
    (iii) The point $D(d, 10)$ lies on the graph. What is the value of d?

12. Determine whether $(2, -1)$ lies on both the graphs of the equations $x - 3y = 5$ and $x + 5y + 3 = 0$.

13. Determine whether $(-5, -2)$ lies on both the graphs of the equations $4x + 3y + 26 = 0$ and $5y - 2x = 1$.

14. Determine whether $(1, \dfrac{3}{2})$ lies on both the graphs of the equations $3x + 2y = 6$ and $4x + 6y = 13$.

15. Determine whether $(-\dfrac{1}{2}, \dfrac{5}{2})$ lies on both the graphs of the equations $x + 3y - 7 = 0$ and $2x + \dfrac{3y}{2} - \dfrac{11}{4} = 0$.

16. The figure shows the graph of the equation $2x + 3y = 11$. P is a point on the graph.
    (a) Find the y-coordinate of P.
    (b) Determine whether the graph passes through each of the following points.
         (i) $(-2, 5)$ **(ii)** $(2, 3)$
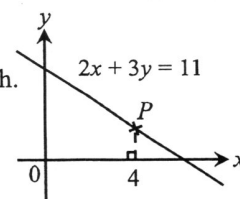
17. The figure shows the graph of the equation $3x - 2y = 8$. Q is a point on the graph.

   (a) Find the x-coordinate of Q.

   (b) Determine whether the graph passes through the point $(-2, -6)$.

   (c) Determine whether the graph cuts the y-axis at $(0, -4)$.
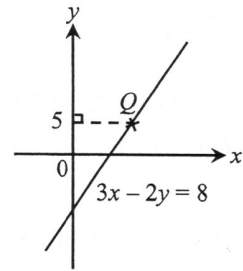
18. The figure shows the graph of the equation $5x - 4y = 6$. R is a point on the graph.

   (a) Find the coordinates of R.

   (b) John is going to draw the graph of $5x - 8y = 12$ on the same rectangular coordinate plane. Does the graph pass through R?
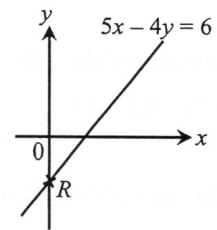
19. Consider the equation $y = mx + c$, where m and c are constants.

   (a) $A(0, 3)$ and $B(6, 0)$ lie on the graph of the equation. Find the values of m and c.

   (b) Determine whether the graph passes through the point $(-8, 7)$.

20. Consider the equation $px - 3y = 8$, where p is a constant.

   (a) $P(-1, p)$ and $Q(q, 4)$ lie on the graph of the equation. Find the values of p and q.

   (b) $R(r, -6)$ lies on the graph of the equation. Find the value of r.

Solve Simultaneous Linear Equations in Two Unknowns by using the Graphical Method

If the graphs of two linear equations in two common unknowns intersect, then the coordinates of the point of intersection are the solution of the simultanous linear equations.

Using the given graphs, write down the solution of the simultaneous equations $\begin{cases} x+3y=5 \\ y=2x-3 \end{cases}$.
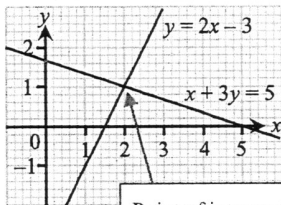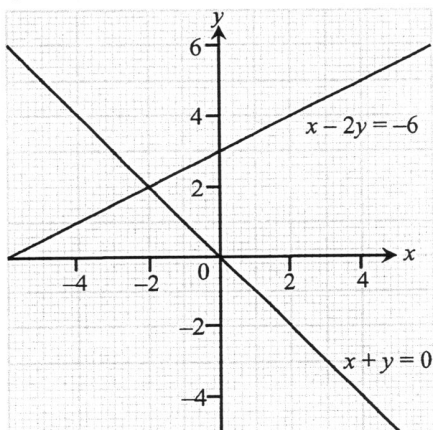

Point of intersection: (2, 1)

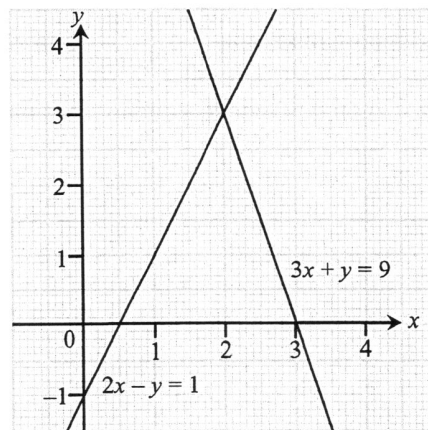From the fig..., ..., $y = 1$.

Exercise 9B

In each of the following, write down the solution of the simultaneous linear equations in two unknowns. (1 – 4)

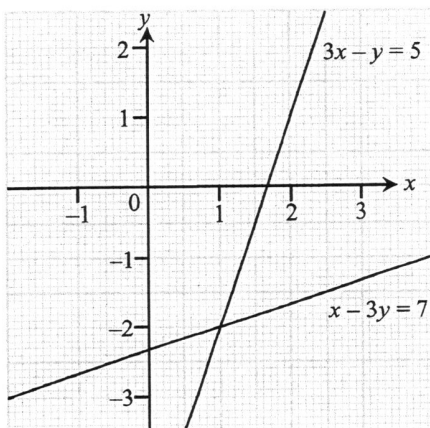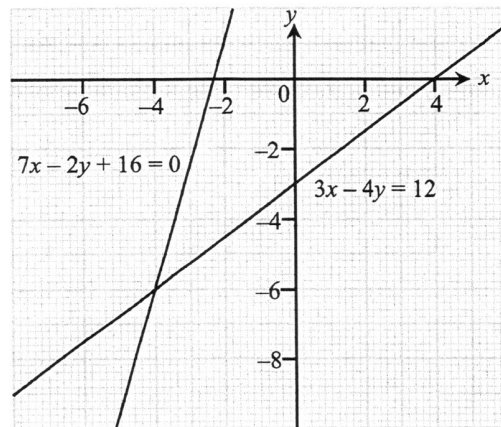**1.** $\begin{cases} x+y=0 \\ x-2y=-6 \end{cases}$

2. $\begin{cases} 3x+y=9 \\ 2x-y=1 \end{cases}$

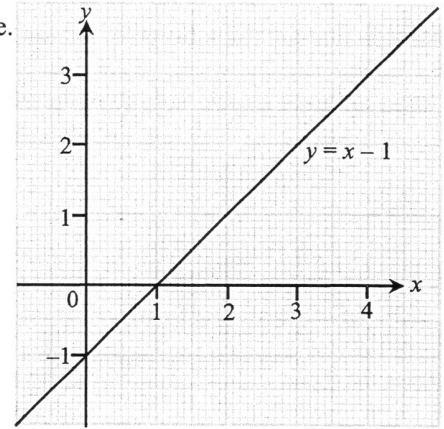**3.** $\begin{cases} 3x-y=5 \\ x-3y=7 \end{cases}$

**4.** $\begin{cases} 3x-4y=12 \\ 7x-2y+16=0 \end{cases}$

4

5.   The figure on the right shows the graph of $y = x - 1$. Solve the simultaneous equations $\begin{cases} y = x - 1 \\ y = 3 - x \end{cases}$ by

drawing the graph of $y = 3 - x$ on the same rectangular coordinate plane.

6.   The figure on the right shows the graph of $y = x - 3$. Solve the

simultaneous equations $\begin{cases} y = x - 3 \\ x + 2y = 0 \end{cases}$ by drawing the graph of

$x + 2y = 0$ on the same rectangular coordinate plane.
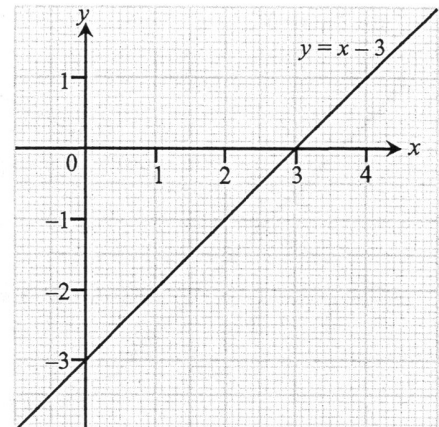
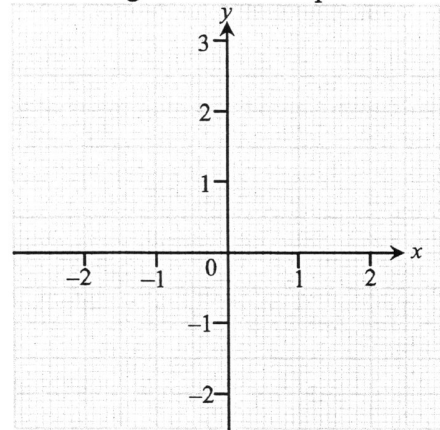7.   **(a)** Draw the graphs of the equations $y = 2x + 2$ and $x - 2y = 2$

on the rectangular coordinate plane provided.

(b) Using the graphs in **(a)**, solve the simultaneous equations

$\begin{cases} y = 2x + 2 \\ x - 2y = 2 \end{cases}$.

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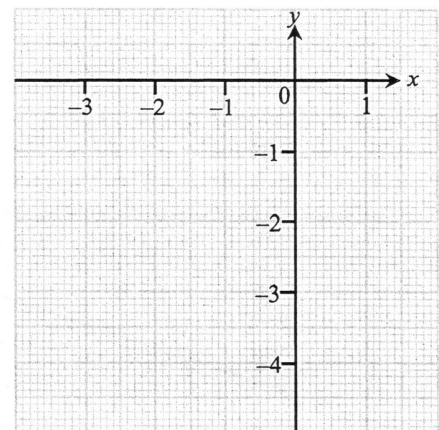
8. **(a)** Draw the graphs of the equations $y = x + 1$ and $y = \dfrac{x}{2} + 1$ on the rectangular coordinate plane provided.

(b) Using the graphs in **(a)**, solve the simultaneous equations

$$\begin{cases} y = x + 1 \\ y = \dfrac{x}{2} + 1 \end{cases}.$$

In each of the following, solve the simultaneous equations by the graphical method. (9 – 18)

[Suggested scale for both axes: 10 divisions (1 cm) = 1 unit]

9. $\begin{cases} y = -2x \\ y = 3x \end{cases}$

10. $\begin{cases} y = 2x \\ y = 5 - 3x \end{cases}$

11. $\begin{cases} y = 2x + 1 \\ y = -x - 2 \end{cases}$

12. $\begin{cases} y = x - 1 \\ y = 2x - 1 \end{cases}$

13. $\begin{cases} y = x + 1 \\ y = 2(x - 1) \end{cases}$

14. $\begin{cases} y = -x \\ y = -\dfrac{x}{2} - 1 \end{cases}$

15. $\begin{cases} y = x + 2 \\ y = \dfrac{x + 3}{2} \end{cases}$

16. $\begin{cases} y = x - 2 \\ x - 2y = 1 \end{cases}$

17. $\begin{cases} x + 3y = 4 \\ 3x - 2y = 1 \end{cases}$

18. $\begin{cases} 2x + 5y + 17 = 0 \\ 3x + 2y + 9 = 0 \end{cases}$

In each of the following, write down the solution of the simultaneous linear equations in two unknowns.

(Give the answers correct to 1 decimal place if necessary.) (19 – 24)

19. $\begin{cases} x - 2y + 1 = 0 \\ 3x + y = 9 \end{cases}$
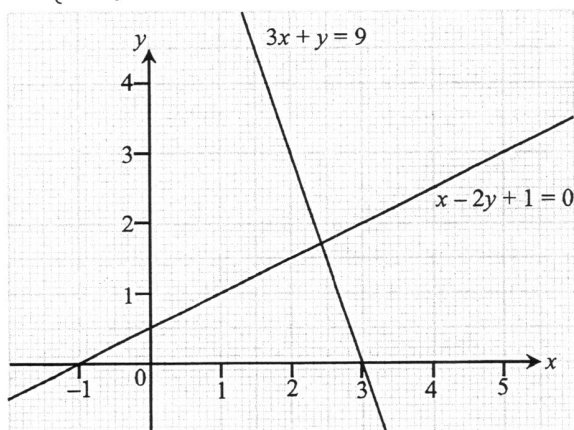
20. $\begin{cases} x + 5y = 18 \\ 6x + 5y = 7 \end{cases}$

6

21. $\begin{cases} x - 4y = 7 \\ 4x - 3y = -8 \end{cases}$

22. $\begin{cases} x - 6y = 15 \\ 3x + 4y = -7 \end{cases}$
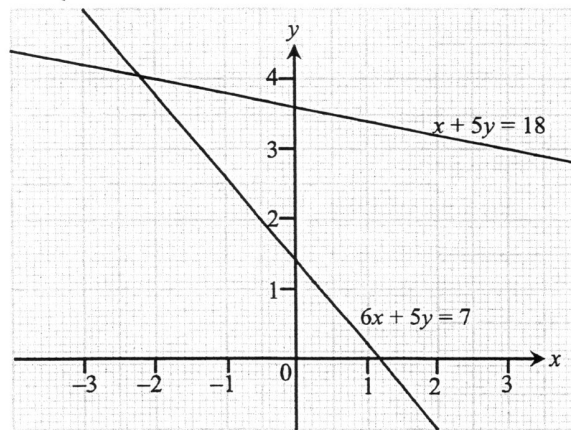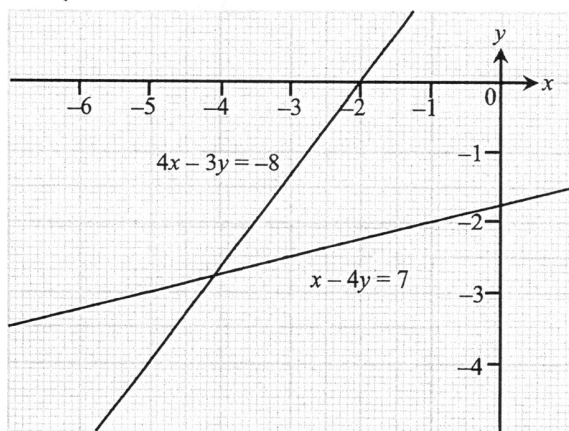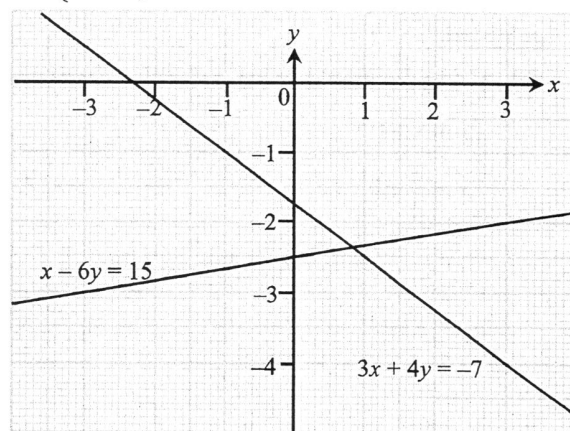

23. $\begin{cases} 3x + 7y - 5 = 0 \\ 5x - 3y + 6 = 0 \end{cases}$
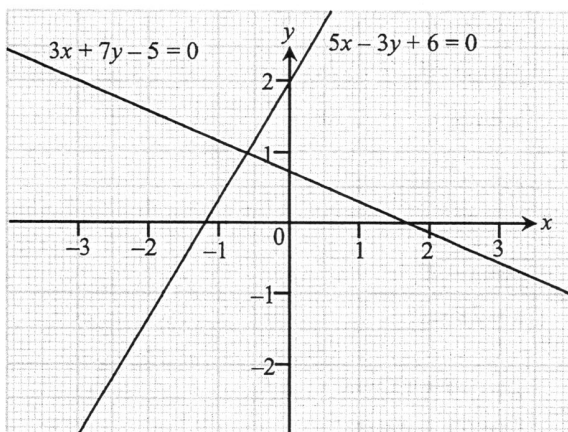
24. $\begin{cases} x - 3y + 5 = 0 \\ 5x - 2y = 5 \end{cases}$
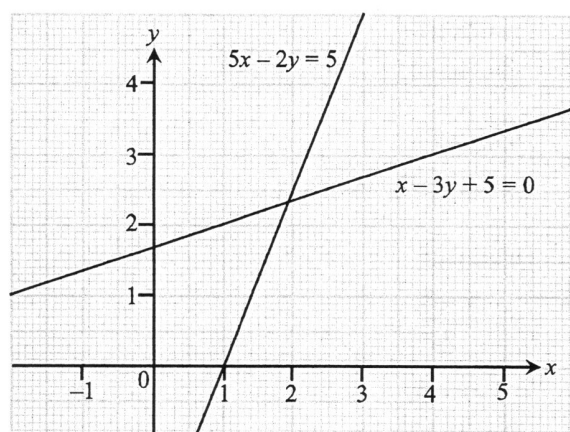
Solve each of the following simultaneous equations by the graphical method.

[*Suggested scale for both axes: 10 divisions (1 cm) = 1 unit*] (25 – 32)

(*Give the answers correct to 1 decimal place if necessary.*)

25. $\begin{cases} y = x + 4 \\ 4x + 3y = 7 \end{cases}$

26. $\begin{cases} y = 3x + 4 \\ 3x - 5y = 1 \end{cases}$

27. $\begin{cases} 2x + 3y = 1 \\ y = 3x + 5 \end{cases}$

28. $\begin{cases} x + y = 3 \\ 3x - 2y = 5 \end{cases}$

29. $\begin{cases} x + y = 2 \\ 5x - 4y + 19 = 0 \end{cases}$

30. $\begin{cases} 3x - 2y = 2 \\ 3x - 4y = 3 \end{cases}$

31. $\begin{cases} x - 2y + 4 = 0 \\ 4x - 5y + 5 = 0 \end{cases}$

32. $\begin{cases} 3x - 5y + 12 = 0 \\ 2x + 7y - 11 = 0 \end{cases}$

7

33. The figure shows the graphs of the simultaneous equations $\begin{cases} x - 3y + 4 = 0 \\ y = mx + 3 \end{cases}$ which intersect at a point on

the x-axis, where m is a constant. Find the value of m.
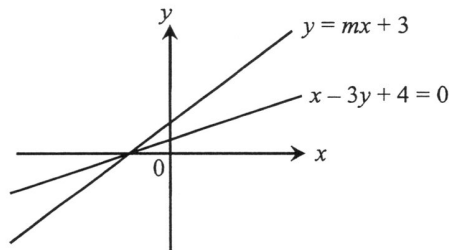
34. The figure shows the graphs of the simultaneous equations $\begin{cases} kx - y = 8 \\ 3x + 5y + 1 = 0 \end{cases}$ which intersect at a point

$(a, -2)$, where a and k are constants. Find the values of a and k.
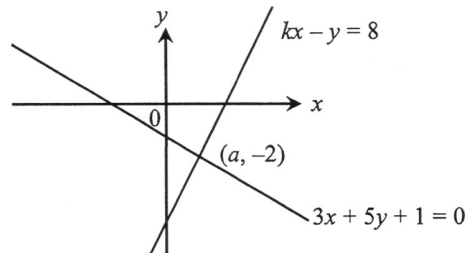
35. $ax + by = c$ and $px + qy = r$ are linear equations in two unknowns x and y, where a, b, c, p, q and r are constants. The points $(1, -3)$ and $(4, 2)$ lie on the graph of $ax + by = c$. The graph of $px + qy = r$ passes through $(2, 2)$ and $(3, -3)$. Solve the simultaneous equations $\begin{cases} ax + by = c \\ px + qy = r \end{cases}$ graphically.

8

Solve Simultaneous Linear Equations in Two Unknowns by using the Method of Substitution

Solve the simultaneous equations $\begin{cases} 2x+y-3=0 \\ y=2x-1 \end{cases}$ by the method of substitution.

$\begin{cases} 2x+y-3=0 \ \ldots\ldots\ldots(1) \\ y=2x-1 \ \ldots\ldots\ldots(2) \end{cases}$

Put (2) into (1).

$2x+(2x-1)-3=0$

$\qquad\quad 4x-4=0$

$\qquad\qquad\quad x=1$

Put $x=1$ into (2).

$y=2(1)-1=1$

$\therefore$ The solution is $x=1$, $y=1$.

Exercise 9C

Solve each of the following simultaneous equations by the method of substitution. (1 – 18)

1. $\begin{cases} y=x \\ y=12+4x \end{cases}$

2. $\begin{cases} x=-y \\ 4x+3y=1 \end{cases}$

3. $\begin{cases} y=3-4x \\ y=4-3x \end{cases}$

4. $\begin{cases} x+y=0 \\ y=4x-15 \end{cases}$

5. $\begin{cases} y=2-3x \\ x=5y+6 \end{cases}$

6. $\begin{cases} x=5y+2 \\ 5x+3y=38 \end{cases}$

7. $\begin{cases} x=17-5y \\ 2x+3y=6 \end{cases}$

8. $\begin{cases} 4x-3y=26 \\ y=8-2x \end{cases}$

9. $\begin{cases} x+y=1 \\ x+2y=4 \end{cases}$

10. $\begin{cases} x-y=6 \\ 2x+y=9 \end{cases}$

11. $\begin{cases} x-3y=-27 \\ x+4y=29 \end{cases}$

12. $\begin{cases} 4x+y=42 \\ 5x-y=39 \end{cases}$

13. $\begin{cases} 4x+3y=39 \\ 2x-y=7 \end{cases}$

14. $\begin{cases} 9y-x=2 \\ 2x+3y=17 \end{cases}$

15. $\begin{cases} 28=4x-y \\ 32=5x-2y \end{cases}$

16. $\begin{cases} 5=x+y \\ 28=4x+5y \end{cases}$

17. $\begin{cases} x-y-15=0 \\ 3x+y-45=0 \end{cases}$

18. $\begin{cases} 5x+y-28=0 \\ 4x-y-26=0 \end{cases}$

Solve each of the following simultaneous equations by the method of substitution. (19 – 36)

19. $\begin{cases} \dfrac{y}{3} = x - 3 \\ 3x + 2y = 18 \end{cases}$

20. $\begin{cases} y = -\dfrac{13 + 2x}{7} \\ 3(x + y) = -2y - 14 \end{cases}$

21. $\begin{cases} 3x + 4y = 27 \\ 5x - 3y = 16 \end{cases}$

22. $\begin{cases} 5x + 8y = 31 \\ 4x + 3y = 18 \end{cases}$

23. $\begin{cases} -7x - 4y = 37 \\ 3x - 5y = 11 \end{cases}$

24. $\begin{cases} 2x - 7y = 44 \\ 4x - 5y = 43 \end{cases}$

25. $\begin{cases} \dfrac{x}{5} + 3y = \dfrac{5}{2} \\ 2(x + 1) = 1 - 4y \end{cases}$

26. $\begin{cases} \dfrac{x}{5} + \dfrac{1}{11} = \dfrac{6y}{55} \\ 4x + 2y = 17 \end{cases}$

27. $\begin{cases} 7x - 8y = \dfrac{3}{2} \\ \dfrac{x}{35} + \dfrac{y}{21} = \dfrac{1}{6} \end{cases}$

28. $\begin{cases} \dfrac{y}{15} - \dfrac{x}{10} = \dfrac{1}{24} \\ \dfrac{x}{2} - \dfrac{y}{10} = \dfrac{1}{5} \end{cases}$

29. $\begin{cases} 3x - 4y = \dfrac{3}{2} \\ 5x + 2y = \dfrac{1}{3} \end{cases}$

30. $\begin{cases} 2x + 5y = \dfrac{1}{8} \\ 3x + 7y = \dfrac{1}{4} \end{cases}$

31. $x + 3y = 2x + 9y = 2$

32. $4x + y = 2x - 7y = 9$

33. $2x + 5y = 3x + 7y = 3$

34. $7x - 12y = 4x - 7y = 2$

35. $8x - 13y = 2x + 3y = 1$

36. $5x + 3y = 2(x - 6) + 5y = -1$

Solve Simultaneous Linear Equations in Two Unknowns by using the Method of Elimination

Solve each of the following simultaneous equations by the method of elimination $\begin{cases} 3x - 5y = 2 \\ 2x + 5y = 18 \end{cases}$.

$\begin{cases} 3x - 5y = 2 \ldots\ldots\ldots(1) \\ 2x + 5y = 18 \ldots\ldots\ldots(2) \end{cases}$

$(1) + (2)$:

$(3x - 5y) + (2x + 5y) = 2 + 18$

$\qquad\qquad\qquad x = 4$

Put $x = 4$ into (1).

$3(4) - 5y = 2$

$\qquad\qquad y = 2$

$\therefore$ The solution is $x = 4$, $y = 2$.

Exercise 9D

Solve each of the following simultaneous equations by the method of elimination. (1 – 18)

1. $\begin{cases} x + y = 2 \\ x - y = 4 \end{cases}$

2. $\begin{cases} x + y = 3 \\ -x + y = -1 \end{cases}$

3. $\begin{cases} x - 2y = -1 \\ x + 2y = 11 \end{cases}$

4. $\begin{cases} 5x + y = 28 \\ 5x - y = 32 \end{cases}$

5. $\begin{cases} x - y = 5 \\ x - 2y = 8 \end{cases}$

6. $\begin{cases} x + 3y = 15 \\ 5x + 3y = 51 \end{cases}$

7. $\begin{cases} x + 5y = 49 \\ 4x - 5y = -4 \end{cases}$

8. $\begin{cases} 5x + y = 22 \\ 5x + 4y = 13 \end{cases}$

9. $\begin{cases} 2x - 3y = 1 \\ 2x + y = 21 \end{cases}$

10. $\begin{cases} 5x - 4y = 22 \\ x - 4y = 14 \end{cases}$

11. $\begin{cases} 5x + 2y + 13 = 0 \\ 5x + 4y + 21 = 0 \end{cases}$

12. $\begin{cases} 5x + y - 26 = 0 \\ 2x - y - 9 = 0 \end{cases}$

13. $\begin{cases} x - 3y + 11 = 0 \\ 2x - 3y + 16 = 0 \end{cases}$

14. $\begin{cases} 3y = x + 15 \\ 2x - 3y + 15 = 0 \end{cases}$

15. $x + 2y = 2y - x = 8$

16. $-7x + 3y = 2x - 3y = 5$

17. $4x + 5y = -(4x - y) = 6$

18. $2x + 4y = -2x + 3y + 3 = 26$

Solve each of the following simultaneous equations by the method of elimination. (19 – 34)

19. $\begin{cases} x - 8y = 29 \\ 3x + 5y = 0 \end{cases}$

20. $\begin{cases} 2x - y = 1 \\ 4x - 7y = -2 \end{cases}$

21. $\begin{cases} 3x + 4y = 4 \\ 6x + 7y = 1 \end{cases}$

22. $\begin{cases} 2x + 5y + 5 = 0 \\ 7x + 10y + 4 = 0 \end{cases}$

23. $\begin{cases} 8x - 4y = 7 \\ -2x + 6y = -3 \end{cases}$

24. $\begin{cases} -8x + 17y + 2 = 0 \\ -2x + 5y + 5 = 0 \end{cases}$

25. $\begin{cases} 3x + 2y = -2 \\ 7x - 3y = 3 \end{cases}$

26. $\begin{cases} 5x + 2y = -20 \\ 4x + 5y = 1 \end{cases}$

27. $\begin{cases} 2x - 3y = 3 \\ 3x + 8y = 2 \end{cases}$

28. $\begin{cases} 7x + 10y + 1 = 0 \\ 3x + 8y + 19 = 0 \end{cases}$

29. $y - x = 5x + 3y = 4$

20. $2x + 5y = 3(2x - y) = 1$

31. $3x + 4y = 2x + 3y = 4$

32. $4x - 2y = 5x - 4y = 12$

33. $\begin{cases} 1.3x + 0.4y = 8.2 \\ 3x - 4y = 14 \end{cases}$

34. $\begin{cases} 0.9x + 1.9y = 0.3 \\ 0.2x + 1.7y = 3.9 \end{cases}$

Exercise 9E

Solve each of the following simultaneous equations. (1 – 12)

1. $\begin{cases} 2x = 5y \\ x - 4y = 3 \end{cases}$

2. $\begin{cases} x - 5y = 9 \\ 3x + 5y = 3 \end{cases}$

3. $\begin{cases} 3x - 2y = 3 \\ 7x - 3y = 2 \end{cases}$

4. $\begin{cases} 2x + 4y = 1 \\ 3(x+1) + 8y = 1 \end{cases}$

5. $\begin{cases} 3x + \dfrac{5y}{2} + 1 = 0 \\ 5x + 3y + 1 = 0 \end{cases}$

6. $\begin{cases} \dfrac{x}{3} + \dfrac{2y}{5} = 2 \\ \dfrac{x}{3} - 2y + 1 = 4 \end{cases}$

7. $\begin{cases} \dfrac{x}{4} + \dfrac{y}{6} = 1 \\ 2x + \dfrac{y}{3} + 4 = 0 \end{cases}$

8. $\begin{cases} -0.6x + 1.7y = 10.7 \\ 0.8x - 0.9y = -4.7 \end{cases}$

9. $\dfrac{2x - 3y}{3} = \dfrac{-3x + 7y}{2} = 1$

10. $7.5x - 2y + 1 = 2.5x - 6y = 4$

11. $3.2x - 5y = 1.2x + 6y = 6.3$

12. $0.3x + 1.67 = 0.5x + 1.9y - 2.75 = 1.3y$

13. It is given that $(-3, 4)$ is the solution of the simultaneous equations $\begin{cases} ax + by = 22 \\ bx - ay = -29 \end{cases}$, where a and b are constants. Find the values of a and b.

14. It is given that $(2, -1)$ is the solution of the simultaneous equations $\begin{cases} mx + ny = 7 \\ nx + my = 1 \end{cases}$, where m and n are constants. Find the values of m and n.

15. It is given that $(-2, -5)$ is the solution of the simultaneous equations $\begin{cases} px - qy - 20 = 0 \\ qx + py + 37 = 0 \end{cases}$, where p and q are constants. Find the values of p and q.

16. If $\begin{cases} y = 4x - 3c \\ x = 4y + 12 \end{cases}$, where c is a constant, find $x + y$ in terms of c.

17. If $\begin{cases} y = 3x + 2k \\ x = 3y - 8 \end{cases}$, where k is a constant, find $x - y$ in terms of k.

18. Find the coordinates of the point of intersection A in the figure.
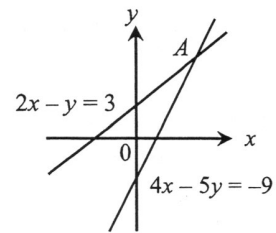
19. Find the coordinates of the point of intersection B in the figure.
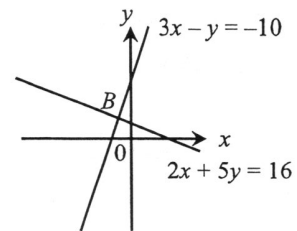
20. (a) Solve $\begin{cases} 2x + 4y = 5 \\ 3x - 2y = 5 \end{cases}$.

(b) Using the result of **(a)**, solve $\dfrac{2}{p} + \dfrac{4}{q} = \dfrac{3}{p} - \dfrac{2}{q} = 5$.

Solving Practical Problems

Steps in solving real-life problem relating simultaneous equations
**Step 1**: Identify the two unknowns to be found in the problem and use different letters to represent the unknowns.
Step 2: According to the conditions in the problem, set up simultaneous linear equations in two unknowns.
**Step 3**: Solve the simultaneous equations. Then draw a conclusion.

Exercise 9F

1. a and b are two numbers, where a is greater than b. If the sum of a and b is 13 and their difference is 7, find the values of a and b.

2. p and q are two numbers. If p is equal to twice of q and p is greater than q by 4, find the values of p and q.

3. c and d are two numbers. If c is equal to three times of d and c is less than four times d by 6, find the values of c and d.

4. The sum of two numbers is 33 and the smaller number is $\dfrac{3}{8}$ the larger number. Find these two numbers.

5. The sum of two numbers is 27. The larger number is greater than three times the smaller one by 11. Find these two numbers.

6. The difference of two numbers is 16. The larger number is less than twice the smaller one by 5. Find these two numbers.

7. The difference of two numbers is 24 and the larger number is greater than $\dfrac{7}{3}$ the smaller number by 4. Find these two numbers.

8. In the figure, the perimeter of the triangle is 28 cm and that of the rectangle is 48 cm. Find the values of x and y.
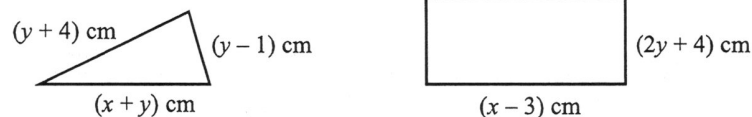
9. In the figure, the perimeter and the area of the trapezium are 50 cm and 100 cm^2 respectively. Find the values of x and y.
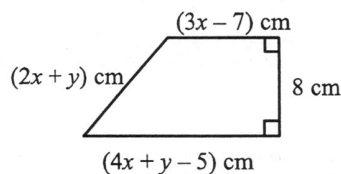
10. The perimeter of a rectangle is 50 cm. If the width of the rectangle is less than $\frac{2}{5}$ the length by 3 cm, find the area of the rectangle.

11. Jack's weight is x kg and Chris's weight is y kg.
    (a) The total weight of Jack and Chris is 145 kg. Set up an equation connecting x and y.
    (b) Jack weighs 15 kg heavier than Chris. Set up an equation connecting x and y.
    (c) Using the results of (a) and (b), find the weight of each of them.

12. Jessica's height is x cm and Winnie's height is y cm.
    (a) Jessica is 35 cm taller than Winnie. Set up an equation connecting x and y.
    (b) The height of Jessica is $\frac{5}{4}$ the height of Winnie. Set up an equation connecting x and y.
    (c) Using the results of (a) and (b), find the height of each of them.

13. There are 35 students in S2B. The number of girls is three more than that of boys. How many boys and girls are there in S2B?

14. Carmen and Linda share 70 candies. If Carmen gets four more candies than Linda gets, how many candies does Linda get?

15. Amy has a $50 note and a $20 note. She exchanges all the money for a total number of 23 $2 coins and $5 coins. How many $5 coins does she get?

16. There are 15 passengers in a lift. The total weight of the passengers is 800 kg. The average weights of child passengers and adult passengers are 40 kg and 60 kg respectively. Find the numbers of child passengers and adult passengers in the lift.

17. The total price of three pencils and five rulers is $49, while the total price of six pencils and three rulers is $42. Find the prices of each pencil and each ruler.

18. The price of a rose is $12 less than twice that of a carnation. If Marco buys a dozen roses and five carnations for $320, find the prices of a rose and a carnation.

19. In a theme park, there are some parrots and some turtles. They have 40 heads and 124 feet. How many parrots and turtles are there in the theme park?

20. The total number of CDs and DVDs on a shelf is 126. If the number of CDs is $\frac{3}{4}$ that of DVDs, find the difference between the numbers of CDs and DVDs on the shelf.

21. The tens digit of a two-digit number is 2 less than twice its units digit. If twice of the tens digit is equal to three times the units digit, find the two-digit number.

22. In the figure, ABC is an equilateral triangle.
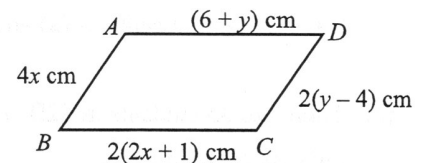   **(a)** Find the values of x and y.
    (b) Find the perimeter of triangle ABC.

    A
    $(2y + 3)$ cm / \ $(2x - 5)$ cm
    B —— *C*
    $(x - y + 1)$ cm
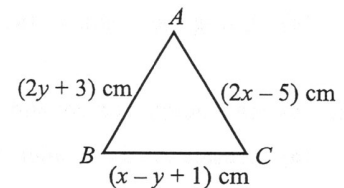
23. In the figure, $ABCD$ is a parallelogram.
    (a) Find the values of x and y.
    (b) Find the perimeter of parallelogram $ABCD$.

    A $(6 + y)$ cm *D*
    $4x$ cm
    $2(y - 4)$ cm
    B $2(2x + 1)$ cm *C*

24. The sum of the present ages of Anthony and his mother is 56. Eight years ago, the age of Anthony's mother was four times the age of Anthony. Find the present age of Anthony.

25. Daisy is 12 years older than Carmen. In 2003, the age of Daisy was three times the age of Carmen. Find the ages of Daisy and Carmen in 2014.

26. A mathematics test consists of 45 multiple choice questions. 2 marks are awarded for each correct answer and 1 mark is deducted for each wrong answer. If Ryan answers all the questions in the test and he gets 45 marks, how many questions does he answer correctly?

27. The total price of four apples is the same as the total price of three oranges. Ivy buys six apples and eight oranges for $75. By how much is the price of an orange more than that of an apple?

28. Three years ago, the ages of Cindy and Jason were in the ratio 5 : 3. Five years from now, the sum of their ages will be 40. By how many years is Cindy older than Jason?

29. A wire of length 2 m is cut into two parts. One part is bent to form a regular pentagon. Another part is bent to form a regular octagon. If the length of the side of the regular pentagon is 1 cm longer than that of the regular octagon, find the length of the side of the regular octagon.

30. Jason buys eight pens and five highlighters for $144. If the price of a pen is decreased by 25% and the price of a highlighter is increased by 37.5%, Jason can buy exactly one highlighter more with the same amount of money. Find the original price of a highlighter.

31. The numerator of a fraction is 3 less than the denominator. If the numerator and the denominator are both decreased by 5, the value of the new fraction formed will be $\frac{2}{3}$. Find the original fraction.

32. The sum of the digits of a two-digit number is 12. If the two digits are reversed, the value of the number will be increased by 36. Find the original number.

33. Amy and Ben share a sum of money. Amy's share is $\frac{2}{3}$ Ben's share. If Amy give $22 to Ben, Amy's share is $\frac{1}{2}$ Ben's share. Find the original amount that each of them share.

34. Rice A and rice B cost $9.6/kg and $7.2/kg respectively. They are mixed such that the total weight of the mixture is 30 kg and the price of the mixture is $7.6/kg. Find the weights of rice A and rice B in the mixture.

35. The price of a pencil is $2.5 and the price of a rubber is $3.5. Ricky buys some pencils and some rubbers for $19.5. How many pencils and rubbers does he buy? Can you give other possible sets of answer? Explain your answer.

36. Billy deposits a total of $50 000 in bank A and bank B at interest rates of 5% p.a. and 8% p.a. respectively. He will get a total amount of $60 560 after three years. Find the principals in bank A and bank B.

37. A sum of money is distributed evenly among a group of people. If there are 2 people less, each people will get $30 more. If there are 2 people more, each people will get $20 less. Find the sum of the money.

Multiple Choice Questions

1. Which of the following is a linear equation in two unknowns?

    A. $a - b = 0$

    B. $a + bc = 1$

    C. $ab = 1$

    D. $a^2 - b = 0$

2. Which of the following is **NOT** a linear equation in two unknowns?

    A. $y = x$

    B. $x - y = 3$

    C. $2x = 3$

    D. $2x + 1 = y$

3. Consider the equation $3x - y + 4 = 0$. When $x = 4$, $y =$

    A. 0.

    B. 8.

    C. 16.

    D. 38.

4. Consider the equation $2y = 5x - 4$. When $y = 8$, $x =$

    A. $\dfrac{12}{5}$.

    B. 4.

    C. 18.

    D. 36.

5. Given that $y = 5 - 3x$, find the values of a and b.

x	1	2	3	4	5
y	2	a	-4	-7	b

    A. $a = -3$, $b = -10$

    B. $a = -1$, $b = -10$

    C. $a = -1$, $b = 20$

    D. $a = 3$, $b = 20$

6. Given that $3x + 2y - 1 = 0$, find the values of m and n.

x	–3	–1	1	3
y	5	m	–1	n

    A. $m = 1, n = -5$

    B. $m = 1, n = -4$

    C. $m = 2, n = -5$

    D. $m = 2, n = -4$

7. Given that $2x + y - 3 = 0$, find the values of h and k.

x	1	h	7	9
y	1	–3	–11	k

    A. $h = 3, k = -21$

    B. $h = 3, k = -15$

    C. $h = 4, k = -21$

    D. $h = 5, k = -15$

8. The table below shows some values of x and y.

| x	–2	–1	1	2
y	–5	–3	1	3

Which of the following may show the relation between x and y?

    A. $y = 2x + 1$

    B. $y = 2x - 1$

    C. $x = 2y + 1$

    D. $x = 2y - 1$

9. Rita has x \$2 coins and y \$10 coins. If the total value of the coins is \$58, then

    A. $x + 5y = 29$.

    B. $5x + y = 29$.

    C. $6x + 6y = 29$.

    D. $6xy = 29$.

10. A can of cola is sold for $6 and a packet of potato chips is sold for $5. If Carol bought x cans of cola and y packets of potato chips for $40, then
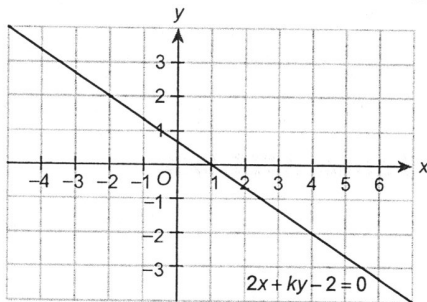
    A. $3xy = 4$.

    B. $5x + 6y = 40$.

    C. $6x + 5y = 40$.

    D. $11x + 11y = 40$.

11. The figure shows the graph of the equation $ax + by + c = 0$.
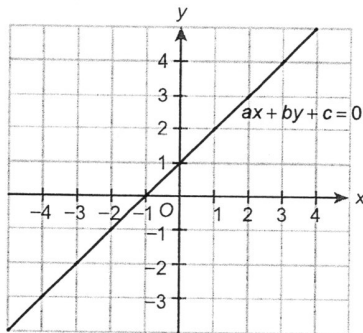
When $x = -3$, $y =$

    A. -4.

    B. -2.

    C. 2.

    D. 4.

12. The figure shows the graph of the equation $2x + ky - 2 = 0$.

Which of the following points lies on the graph above?

    A. $(-2, 4)$

    B. $(0, 1)$

    C. $(2, -2)$

    D. $(4, -2)$

13. Which of the following points lies on the graph of the equation $x = 1 - 4y$?

    A. $(7, 2)$

    B. $(2, -7)$

    C. $(1, 3)$

    D. $(-3, 1)$

14. Which of the graphs of the following equations does not pass through the origin?

    A. $x + y = 0$

    B. $4x - y = 0$

    C. $6 - y = 2x$

    D. $6y = 2x$

15. If $A(a, -9)$ lies on the graph of the equation $y = \dfrac{1}{3}x - 4$, then $a =$

    A. -39.

    B. -15.

    C. -7.

    D. -1.

16. If $M(m, 2m)$ lies on the graph of the equation $3x + 2y - 21 = 0$, then $m =$

    A. 1.

    B. 3.

    C. 5.

    D. 7.

17. If $P(2, -5)$ lies on the graph of the equation $6x + 5y - k = 0$, then $k =$

    A. -26.

    B. -13.

    C. 13.

    D. 26.

18. If $P(-1, 3)$ lies on the graph of the equation $kx - y - 2k = 0$, then $k =$

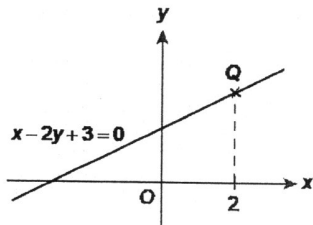   A. 2.

    B. 1.

    C. -1.

    D. -2.

19. The graph of the equation $y = 6x - 3$ cuts the x-axis at

  A. $(0, -3)$.

  B. $(-3, 0)$.

  C. $\left(0, \dfrac{1}{2}\right)$.

  D. $\left(\dfrac{1}{2}, 0\right)$.

20. The graph of the equation $x - 3y + 4 = 0$ cuts the y-axis at

  A. $\left(0, \dfrac{3}{4}\right)$.

  B. $\left(\dfrac{3}{4}, 0\right)$.

  C. $\left(0, \dfrac{4}{3}\right)$.

  D. $\left(\dfrac{4}{3}, 0\right)$.

21. In the figure, Q is a point on the graph of the equation $x - 2y + 3 = 0$. The y-coordinate of Q is
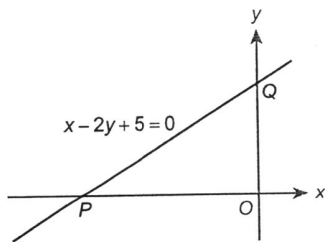

  A.   0.

  B.   1.

  C.   2.

  D.   2.5.

22. The figure below shows the graph of the equation $2x + 3y + k = 0$.
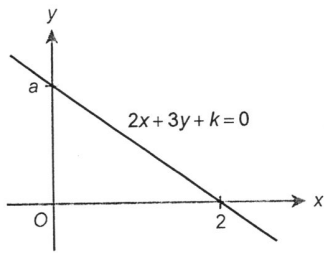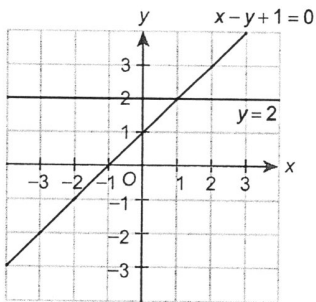

Find the values of k and a.

A. $k = -4$, $a = \dfrac{4}{3}$

B. $k = -4$, $a = \dfrac{3}{4}$

C. $k = 4$, $a = \dfrac{4}{3}$

D. $k = 4$, $a = \dfrac{3}{4}$

23. In the figure, the graph of the equation $x - 2y + 5 = 0$ cuts the x-axis at P and the y-axis at Q.

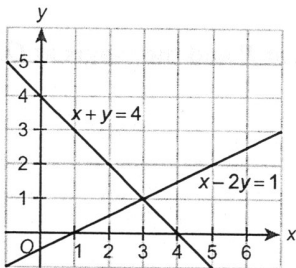

Find the area of $\triangle POQ$.

A. 5 sq. units

B. $\dfrac{25}{4}$ sq. units

C. 10 sq. units

D. 25 sq. units

24. According to the figure, find the solution of the simultaneous equations $\begin{cases} x - y + 1 = 0 \\ y = 2 \end{cases}$.
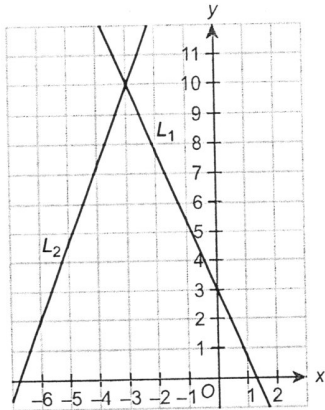

A. $x = 0$, $y = 2$

B. $x = 1$, $y = 2$

C. $x = 2$, $y = 1$

D. $x = 2$, $y = 2$

25. According to the figure, find the solution of the simultaneous equations $\begin{cases} x - 2y = 1 \\ x + y = 4 \end{cases}$.
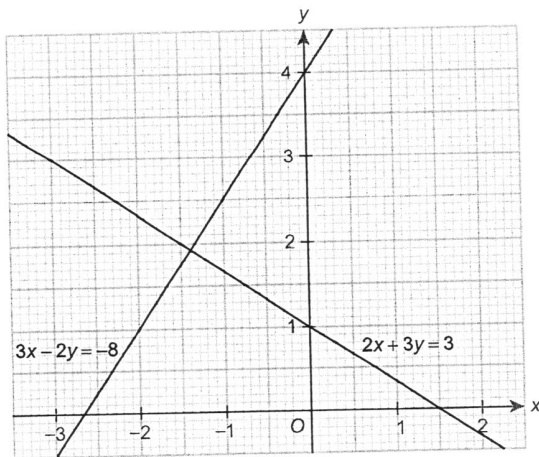

A. $x = 0$, $y = 4$

B. $x = 1$, $y = 0$

C. $x = 1$, $y = 3$

D. $x = 3$, $y = 1$

26. According to the figure, find the solution of the simultaneous equations formed by the equations of L_1 and L_2.
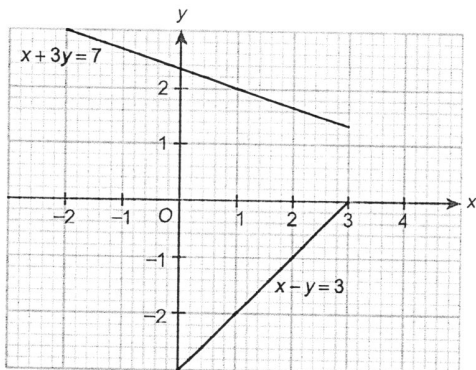

A. $x = -3, y = 10$

B. $x = 3, y = 10$

C. $x = 10, y = -3$

D. $x = 10, y = 3$

27. According to the figure, find the solution of the simultaneous equations $\begin{cases} 2x + 3y = 3 \\ 3x - 2y = -8 \end{cases}$.
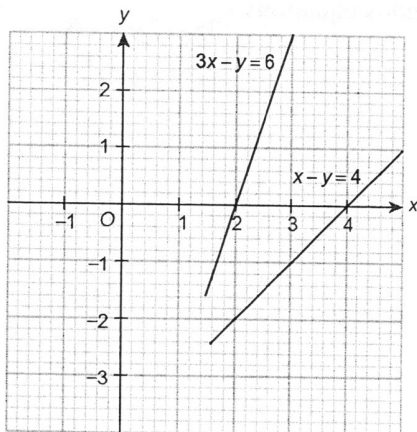

A. $x = -1.0, y = 2.0$ (corr. to 1 d.p.)

B. $x = -1.3, y = 2.0$ (corr. to 1 d.p.)

C. $x = -1.4, y = 1.9$ (corr. to 1 d.p.)

D. $x = -1.5, y = 2.0$ (corr. to 1 d.p.)

28. According to the figure, find the solution of the simultaneous equations $\begin{cases} x - y = 3 \\ x + 3y = 7 \end{cases}$.

A. $x = 1, y = 2$

B. $x = 3, y = 0$

C. $x = 4, y = 1$

D. It cannot be found.

29. According to the figure, find the solution of the simultaneous equations $\begin{cases} x - y = 4 \\ 3x - y = 6 \end{cases}$.

A. $x = 1, y = -3$

B. $x = 1.5, y = -1.5$

C. $x = 2, y = 0$

D. It cannot be found.

30. If $\begin{cases} x = -7 \\ x + 3y = 5 \end{cases}$, then $y =$

    A. -4.

    B. $-\dfrac{2}{3}$.

    C. $\dfrac{2}{3}$.

    D. 4.

31. If $\begin{cases} 5x - y = 12 \\ x = 2y + 6 \end{cases}$, then $x =$

    A. -10.

    B. -2.

    C. 2.

    D. 10.

32. If $\begin{cases} 2x - 3y = 16 \\ 5x + y = 6 \end{cases}$, then $y =$

    A. -5.

    B. -4.

    C. 2.

    D. 16.

33. If $\begin{cases} 3x - 4y = 11 \\ 2x + 3y = 30 \end{cases}$, then $y =$

    A. -4.

    B. $-\dfrac{5}{3}$.

    C. 4.

    D. 9.

34. If $5x + y - 11 = 6x - y = 0$, then $y =$

    A. -6.

    B. 1.

    C. 6.

    D. 66.

35. If $x - 2y + 7 = 2x + 7y = 3$, then $x =$

    A. −6.

    B. −2.

    C. −1.

    D. 1.

36. If $3x + 3y = 4x - 3y = 14$, then $y =$

    A. −10.

    B. $-\dfrac{2}{3}$.

    C. $\dfrac{2}{3}$.

    D. 4.

37. If $\begin{cases} 2(x + y) - 3x = 4 \\ 3(x - y) - 7y = 8 \end{cases}$, then $x =$

    A. −14.

    B. −10.

    C. −5.

    D. 6.

38. If $\begin{cases} 2x + 3(x - y) = 19 \\ 4(x - y) + 3y = 11 \end{cases}$, then $y =$

    A. −19.

    B. −3.

    C. −2.

    D. 2.

39. If $x = 2y + 3$ and $5x - 4y = 0$, then $x - 6y =$

    A. −17.

    B. −13.

    C. 13.

    D. 17.

40. If $y = 3x + 1$ and $7x - 2y + 7 = 0$, then $(y - x)^2 =$

    A. −81.

    B. 81.

    C. 171.

    D. 361.

41. If $\begin{cases} 4x + y = -30 \\ 6x - y = -50 \end{cases}$, then $y =$

    A. −8.

    B. −2.

    C. 2.

    D. 8.

42. If $\begin{cases} 3x + 2y = 34 \\ 3x - 5y = 41 \end{cases}$, then $x =$

    A. −12.

    B. −1.

    C. 1.

    D. 12.

43. If $\begin{cases} 5x + 6y = 27 \\ 6x - y = 16 \end{cases}$, then $y =$

    A. −3.

    B. −2.

    C. 2.

    D. 3.

44. If $\begin{cases} 3x + 5y = 1 \\ x + 4y = 5 \end{cases}$, then $x =$

    A. −3.

    B. −2.

    C. 2.

    D. 3.

45. If $\begin{cases} 4x = 3y + 22 \\ 7x + 3y + 11 = 0 \end{cases}$, then $y =$

    A. −6.

    B. −1.

    C. 1.

    D. 6.

46. If $\begin{cases} \dfrac{x}{2} + \dfrac{2y}{3} = -\dfrac{1}{3} \\ 5x - 4y = -14 \end{cases}$, then $x =$

    A. −2.

    B. −1.

    C. 1.

    D. 2.

47. If $\begin{cases} 5x + 3y = 40 \\ \dfrac{x}{2} - \dfrac{y}{5} = 9 \end{cases}$, then $y =$

    A. −14.

    B. −10.

    C. 10.

    D. 14.

48. If $2x + 11y - 1 = 20 + 3x - 5y = 0$, then $y =$

    A. −5.

    B. −1.

    C. 1.

    D. 5.

49. If $5x + 3y = 4y - 7x = 82$, then $x =$

    A. −24.

    B. −2.

    C. 2.

    D. 24.

50. If $\begin{cases} 5(x-y)-3y=6 \\ 15(x+y)-6x=1 \end{cases}$, then $y =$

    A. $-\dfrac{2}{3}$.

    B. $-\dfrac{1}{3}$.

    C. $\dfrac{1}{3}$.

    D. $\dfrac{2}{3}$.

51. If $2x+3y=2$ and $5x+4y+16=0$, then $x^2+y^2=$

    A. -28.

    B. 4.

    C. 100.

    D. 196.

52. If x equals half of y, and the sum of 4 times x and y is 48, then

    A. $\begin{cases} x=2y \\ 4x+y=48 \end{cases}$.

    B. $\begin{cases} x=2y \\ 4(x+y)=48 \end{cases}$.

    C. $\begin{cases} x=\dfrac{y}{2} \\ 4x+y=48 \end{cases}$.

    D. $\begin{cases} x=\dfrac{y}{2} \\ 4(x+y)=48 \end{cases}$.

53. The weight of Ricky is 1.5 times of Jenny's. The difference between their weights is 24 kg. Find the weight of Ricky.

    A.   36 kg

    B.   48 kg

    C.   60 kg

    D.   72 kg

54. Hilary has some $1.7 stamps and $2.9 stamps. If she has altogether 14 stamps and the total value of the stamps is $31, how many $2.9 stamps does Hilary have?

    A. 6
    B. 7
    C. 8
    D. 9

55. Doris bought 4 pieces of cheesecakes and 3 pieces of chocolate cakes for $187, while Tina bought 2 pieces of cheesecakes and 6 pieces of chocolate cakes for $206. What is the selling price of a piece of cheesecake?

    A. $25
    B. $26
    C. $27
    D. $28

56. There are 300 seats available for the buffet in a hotel. The cost of the buffet for each adult is $480, while the cost for each child is $280. If the hotel had a full house for the buffet yesterday with a total income of $136 000, how many children were there yesterday?

    A. 35
    B. 40
    C. 45
    D. 50

57. If the sum of two numbers is 43 and their difference is 7, find the product of the two numbers.

    A. 50
    B. 198
    C. 301
    D. 450

58. The sum of the units digit and the tens digit of a two-digit number is 12. If the two digits are interchanged, the new number is greater than the original number by 54. Find the original number.

    A. 39
    B. 48
    C. 84
    D. 93

59. The age of Samuel is 5 times of Edith's. After 24 years, the age of Samuel will be 2 times of Edith's. Find the present age of Edith.
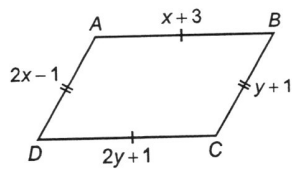
    A. 6
    B. 8
    C. 12
    D. 32

60. The figure shows an equilateral triangle ABC. Find y.
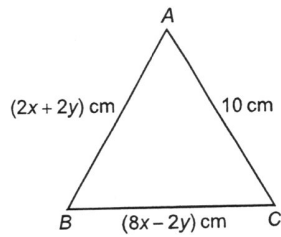
    A. 1
    B. 2
    C. 3
    D. 4

61. The figure shows a parallelogram $ABCD$, where $AB = DC$ and $AD = BC$. Find the perimeter of $ABCD$.

    A. 4
    B. 8
    C. 15
    D. 16