



Linear and simultaneous equations, inequalities and trial and improvement

Grades 4–9 About 90 minutes Calculator allowed
94 marks

Name _____

Class _____

Date _____

A Before you start

Grades 4–5

You will need these in every question below.

A1 Solve $4x - 7 = 21$.

[1 mark]

Answer

A2 Expand and simplify $3(2x - 5) - 2(x - 4)$.

[2 marks]

Answer

A3 Work out the value of $2a^2 - b$ when $a = -3$ and $b = 5$.

[1 mark]

Answer

A4 List the integers n such that $-2 < n \leq 3$.

[1 mark]

Answer

A5 Work out the lowest common multiple of 6 and 4.

[1 mark]

Answer

Your teacher works through each example with you. Then try the one beside it on your own.

EXAMPLE 1

Solve $5(x - 2) = 3x + 4$.

Hint Expand the bracket, then collect the x terms on the side with more of them.

B1 Solve $4(2x + 3) = 5x - 9$. [3 marks]

Answer

EXAMPLE 2

Solve $\frac{x + 3}{4} = \frac{x - 1}{2}$.

Hint Multiply both sides by 4, the lowest common multiple of the denominators.

B2 Solve $\frac{2x - 1}{3} + \frac{x + 2}{4} = 2$. [3 marks]

Answer

EXAMPLE 3

Solve the simultaneous equations $3x + 2y = 16$ and $x - 2y = 0$.

Hint The y terms have the same size and opposite signs, so add the equations.

B3 Solve the simultaneous equations [3 marks]

$$4x + 3y = 6 \quad 2x - 5y = 16$$

Answer $x = \dots\dots$ $y = \dots\dots$

EXAMPLE 4

Solve $7 - 2x > 1$.

Hint Add $2x$ to both sides so that the x term is positive. Then you never divide by a negative number.

B4 Solve $3(x - 4) \geq 5x - 18$. [3 marks]

Answer

C Practice

Grades 5–7

Each question asks for something different. Show your working.

C1 Solve $2(3x - 1) - (x + 4) = 4(x + 2)$. [3 marks]

Answer

C2 Solve $\frac{x}{3} + \frac{x}{5} = 16$. [2 marks]

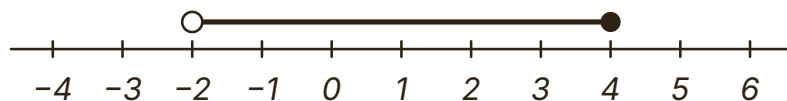
Answer

C3 Solve the simultaneous equations [3 marks]

$$y = 2x - 5 \quad 3x + 2y = 18$$

Answer $x = \dots\dots$ $y = \dots\dots$

C4 The number line shows an inequality.



(a) Write down the inequality shown.

[2 marks]

Answer

(b) List the integers that satisfy the inequality.

[1 mark]

Answer

Total for C4: 3 marks

C5 Solve $-5 \leq 2x + 3 < 11$.

[2 marks]

Answer

C6 3 adult tickets and 2 child tickets for a show cost £41. 2 adult tickets and 5 child tickets cost £47.50. [4 marks]

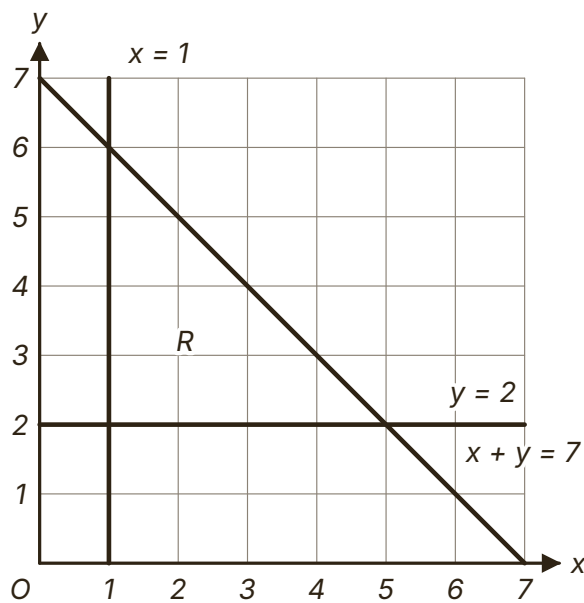
Work out the cost of one adult ticket and the cost of one child ticket.

Answer adult £ child £

- C7** The equation $x^3 + 6x = 100$ has a solution between 4 and 5. [4 marks]
 Use trial and improvement to find this solution. Give your answer to 1 decimal place. You must show your working.

Answer

- C8** The region R is shown on the grid. Write down the three inequalities that define R . [3 marks]



Answer

- C9** n is an integer. $3n + 2 > 11$ and $2n - 3 \leq 15$. [3 marks]
 Find all the possible values of n .

Answer

Answer every question in the space given. Show your working: most of the marks are for method.

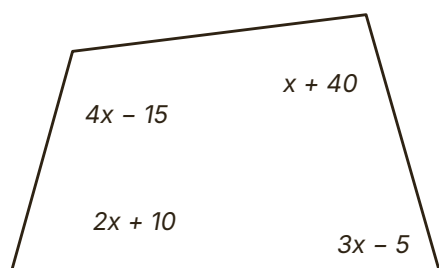
- D1** Ella solves $8 - 3x > 2$. She writes, " $-3x > -6$, so $x > 2$." [2 marks]

Explain what Ella has done wrong, and write down the correct solution.

Answer

- D2** The diagram shows a quadrilateral. The angles are given in degrees. [3 marks]

Work out the size of the largest angle.



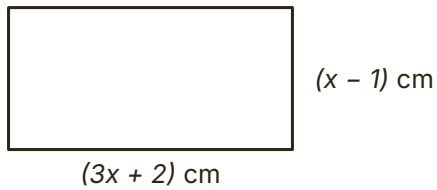
Not drawn accurately

Answer

D3 The perimeter of the rectangle is 50 cm.

[4 marks]

Work out the area of the rectangle.



Not drawn accurately

Answer

D4 Solve the simultaneous equations

[4 marks]

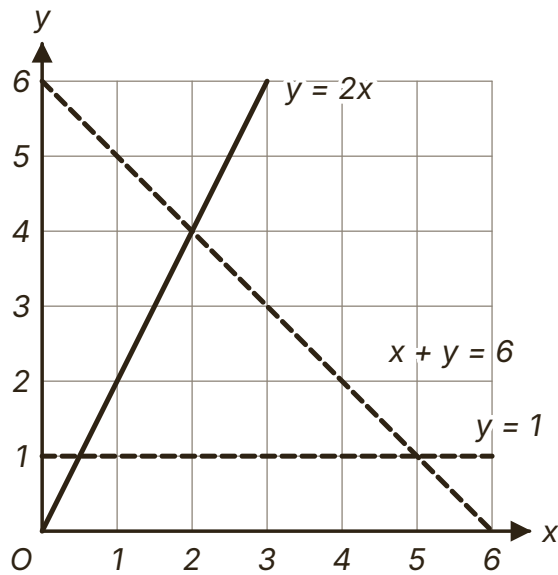
$$5x - 4y = 23 \quad 3x + 6y = -3$$

Answer $x = \dots\dots$ $y = \dots\dots$

D5 The lines $y = 1$, $x + y = 6$ and $y = 2x$ are drawn on the grid.

[3 marks]

List all the points with integer coordinates that satisfy all three of $y > 1$, $x + y < 6$ and $y \leq 2x$.

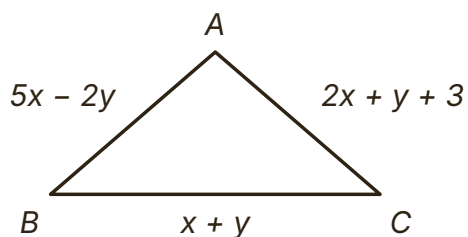


Answer

D6 Triangle ABC is isosceles with $AB = AC$. The lengths of the sides are given in centimetres. The perimeter of the triangle is 43 cm.

[6 marks]

Work out the length of BC .



Not drawn accurately

Answer

D7 A cuboid has a square base of side x cm. Its height is $(x + 3)$ cm. Its volume is 250 cm^3 .

(a) Show that $x^3 + 3x^2 = 250$. [2 marks]

(b) Use trial and improvement to find the value of x . Give your answer to 1 decimal place. You must show your working. [4 marks]

Answer

Total for D7: 6 marks

D8 Solve $\frac{3 - 2x}{4} \geq x - 6$. [3 marks]

Answer

D9 Solve $\frac{x + 4}{3} - \frac{x - 2}{5} = 4$. [3 marks]

Answer

D10 The line $y = mx + c$ passes through the points $(3, 5)$ and $(7, 17)$. [3 marks]

Work out the value of m and the value of c .

Answer $m = \dots\dots$ $c = \dots\dots$

E Extension

Grade 9 and beyond

No route is given. Spend five minutes on a problem before you look at a hint. The hints are on the last page of the worksheet, and you can use one at a time.

- E1** Three numbers a , b and c satisfy $a + b = 11$, $b + c = 15$ and $a + c = 14$. [3 marks]
Work out the values of a , b and c .

Answer $a = \dots\dots$ $b = \dots\dots$ $c = \dots\dots$

- E2** The solution of $4(x - a) = x + 9$ is $x = 7$. [3 marks]
Use this to solve the inequality $2x + a < 5x - 13$.

Answer

- E3** x and y are integers with $x \geq 1$, $y \geq 2$ and $x + y \leq 7$. [3 marks]
Work out the greatest possible value of $2x + 3y$.

Answer

E4 A two-digit number has digits that add up to 11. When the digits are swapped round, [3 marks]
the number goes up by 27.
Work out the number.

Answer

F How did it go?

Colour one circle on each line.

	Not yet	Nearly	Yes
I can solve linear equations with brackets, fractions and the unknown on both sides.	☐	☐	☐
I can solve simultaneous equations by elimination and by substitution, including in a context.	☐	☐	☐
I can solve linear inequalities, show them on a number line, and describe a region with inequalities.	☐	☐	☐
I can use trial and improvement to find a solution to 1 decimal place.	☐	☐	☐

Extension hints

Use one hint at a time. Cover the ones below it with a sheet of paper.

- E1**
- Hint 1** Add all three equations together.
- Hint 2** $2a + 2b + 2c = 40$, so $a + b + c = 20$.
- Hint 3** Take each equation away from 20: $c = 20 - 11 = 9$, $a = 20 - 15 = 5$, $b = 20 - 14 = 6$.
-
- E2**
- Hint 1** Put $x = 7$ into the equation to find a .
- Hint 2** $4(7 - a) = 16$, so $28 - 4a = 16$ and $a = 3$.
- Hint 3** $2x + 3 < 5x - 13$ gives $16 < 3x$, so $x > \frac{16}{3}$.
-
- E3**
- Hint 1** These are the inequalities of region R in question C8. Only the points in R are allowed.
- Hint 2** $2x + 3y = 2(x + y) + y$. Make $x + y$ as big as possible, then make y as big as possible.
- Hint 3** $x + y = 7$ and $y = 6$ (so $x = 1$) give $2 \times 7 + 6 = 20$.
-
- E4**
- Hint 1** Call the tens digit a and the units digit b . The number is $10a + b$.
- Hint 2** $a + b = 11$ and $(10b + a) - (10a + b) = 27$, so $9b - 9a = 27$ and $b - a = 3$.
- Hint 3** Adding $a + b = 11$ and $b - a = 3$ gives $2b = 14$, so $b = 7$, $a = 4$ and the number is 47.