P1 Chapter 3: Inequalities

Inequality Regions

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On graph paper, shade the region that satisfies the inequalities:

$$2y + x < 14$$
$$y \geq x^2 - 3x - 4$$

You did this at GCSE, the only difference here being that the graphs involved might not be straight lines.

?

Step 1: Imagine inequalities as equations and sketch.

Step 2:
An inequality involving x and y represents a 2D region in space. Identify the correct side of each line each inequality represents.

Tip: To quickly sketch $2y + x = 14$, consider what happens when x is 0 and when y is 0.

Tip: Make sure y is on the side where it is positive.
If y is on the smaller side, you're below the line.
If y is on the greater side, you're above the line.

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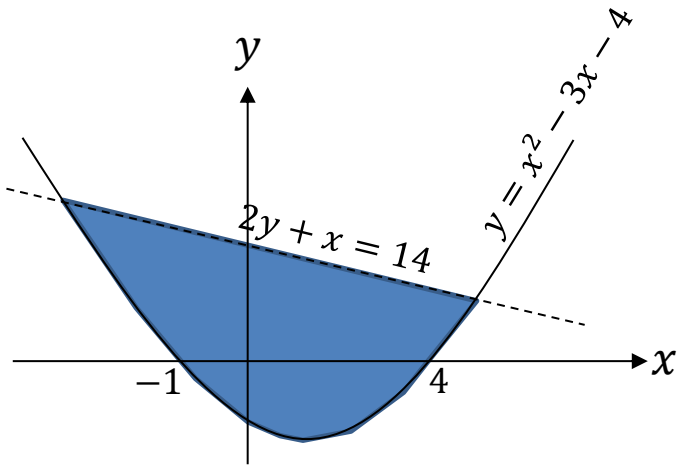

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Exercise 3.7

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Homework Exercise

1 On a coordinate grid, shade the region that satisfies the inequalities:

$y > x - 2$, $y < 4x$ and $y \leqslant 5 - x$.

2 On a coordinate grid, shade the region that satisfies the inequalities:

$x \geqslant -1$, $y + x < 4$, $2x + y \leqslant 5$ and $y > -2$.

3 On a coordinate grid, shade the region that satisfies the inequalities:

$y > (3 - x)(2 + x)$ and $y + x \geqslant 3$.

4 On a coordinate grid, shade the region that satisfies the inequalities:

$y > x^2 - 2$ and $y \leqslant 9 - x^2$.

5 On a coordinate grid, shade the region that satisfies the inequalities:

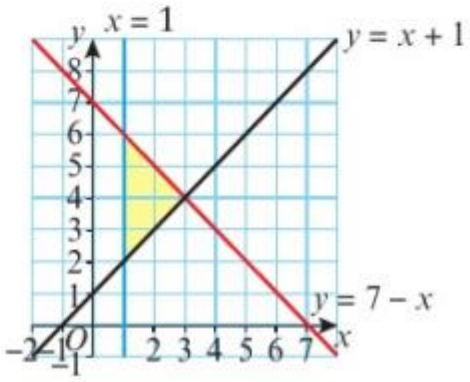
$y > (x - 3)^2$, $y + x \geqslant 5$ and $y < x - 1$.

6 The sketch shows the graphs of the straight lines with equations:

$y = x + 1$, $y = 7 - x$ and $x = 1$.

a Work out the coordinates of the points of intersection of the functions.

b Write down the set of inequalities that represent the shaded region shown in the sketch.

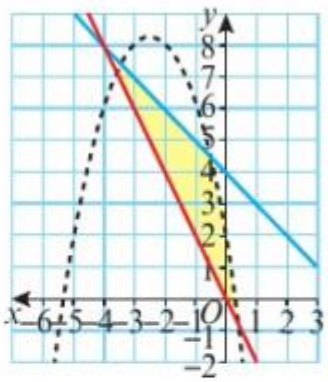


Homework Exercise

7 The sketch shows the graphs of the curves with equations:

$y = 2 - 5x - x^2$, $2x + y = 0$ and $x + y = 4$.

Write down the set of inequalities that represent the shaded region shown in the sketch.



8 **a** On a coordinate grid, shade the region that satisfies the inequalities

$y < x + 4$, $y + 5x + 3 \geqslant 0$, $y \geqslant -1$ and $x < 2$.

b Work out the coordinates of the vertices of the shaded region.

c Which of the vertices lie within the region identified by the inequalities?

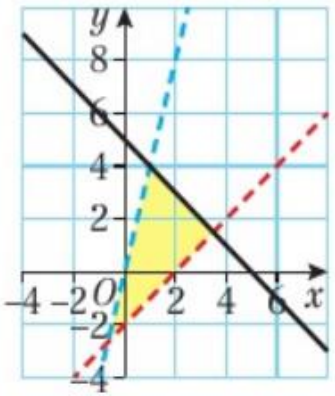
d Work out the area of the shaded region.

Problem-solving

A vertex is only included if both intersecting lines are included.

Homework Answers

1



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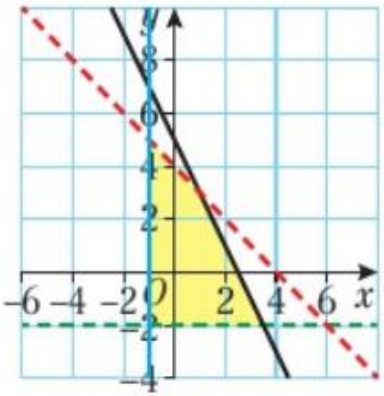

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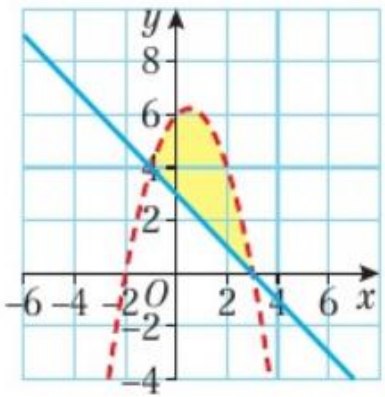

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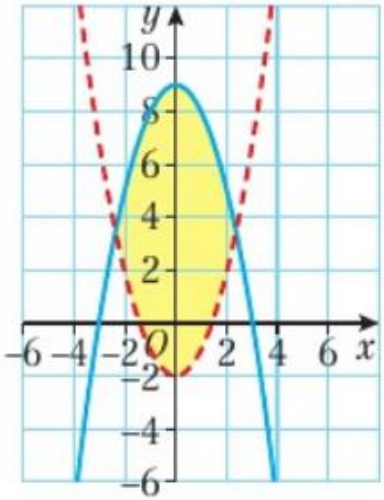

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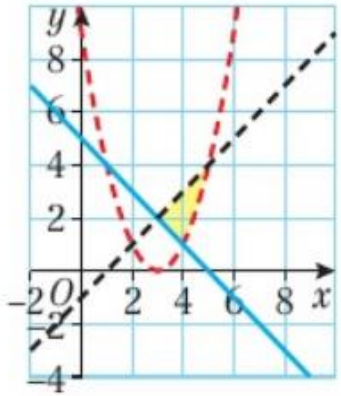
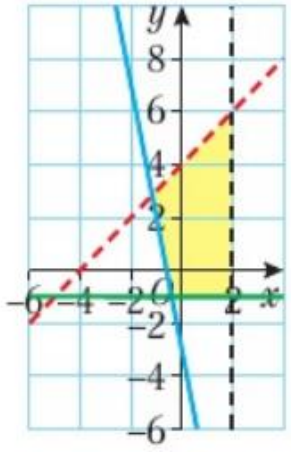


6 **a** (1, 6), (3, 4), (1, 2)

b $x \geqslant 1, y \leqslant 7 - x, y \geqslant x + 1$

7 $y < 2 - 5x - x^2, 2x + y \geqslant 0, x + y \leqslant 4$

8 **a**



b $(-\frac{7}{6}, \frac{17}{6})$, (2, 6), (2, −1), (−0.4, 1)

c (−0.4, 1) **d** $\frac{941}{60}$