Section 4: Linear and quadratic inequalities

Solutions to Exercise

1. (i) $2x + 3 < 10$

$2x < 7$

$x < \frac{7}{2}$

(ii) $5x + 3 \geq 2x - 9$

$3x + 3 \geq -9$

$3x \geq -12$

$x \geq -4$

(iii) $4x + 1 \leq 6x - 7$

$1 \leq 2x - 7$

$8 \leq 2x$

$4 \leq x$

$x \geq 4$

(iv) $5(x - 3) \leq 2(2x + 3)$

$5x - 15 \leq 4x + 6$

$x - 15 \leq 6$

$x \leq 21$

(v) $4(2x + 5) \geq 3(3x - 1)$

$8x + 20 \geq 9x - 3$

$20 \geq x - 3$

$23 \geq x$

$x \leq 23$

(vi) $\frac{2x + 1}{3} > \frac{x - 4}{2}$

$2(2x + 1) > 3(x - 4)$

$4x + 2 > 3x - 12$

$x + 2 > -12$

$x > -14$

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2. (i) $3x-1>7-x$

$4x-1>7$

$4x>8$

$x>2$

The smallest integer value that satisfies the inequality is 3.

(ii) $2(1-x)>3x+4$

$2-2x>3x+4$

$2>5x+4$

$-2>5x$

$-\frac{2}{5}>x$

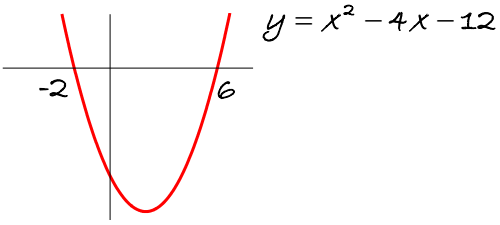
$x<-\frac{2}{5}$

The largest integer value that satisfies the inequality is -1.

3. (i) $x^2-4x-12\leq 0$

$(x-6)(x+2)\leq 0$

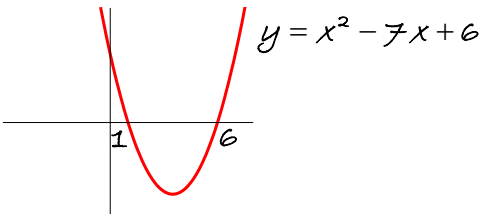
From graph, $-2\leq x\leq 6$



(ii) $x^2-7x+6>0$

$(x-1)(x-6)>0$

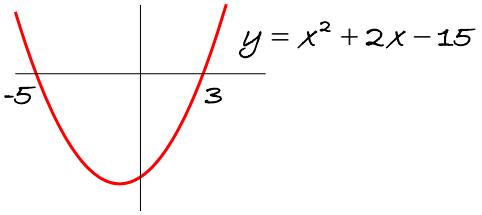
From graph, $x<1$ or $x>6$



(iii) $x^2+2x-15\geq 0$

$(x+5)(x-3)\geq 0$

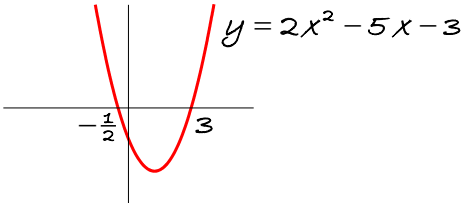
From graph, $x\leq -5$ or $x\geq 3$



(iv) $3x^2+5x+2<0$

$(3x+2)(x+1)<0$

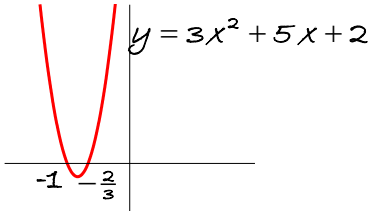
From graph, $-1<x<-\frac{2}{3}$



(v) $4x^2-4x-3>0$

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

From graph, $x<-\frac{1}{2}$ or $x>\frac{3}{2}$



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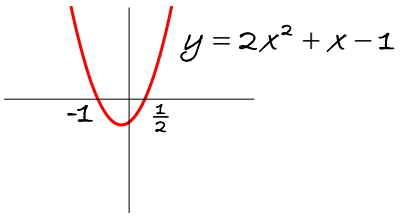
(vi) $1 - x - 2x^2 \geq 0$

$2x^2 + x - 1 \leq 0$

$(2x - 1)(x + 1) \leq 0$

From graph, $-1 \leq x \leq \frac{1}{2}$

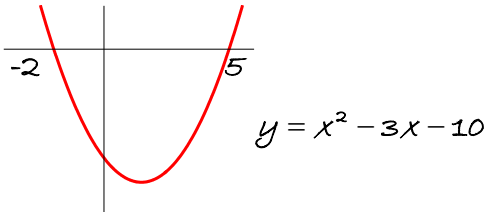


(vii) $x^2 \geq 3x + 10$

$x^2 - 3x - 10 \geq 0$

$(x - 5)(x + 2) \geq 0$

From graph, $x \leq -2$ or $x \geq 5$



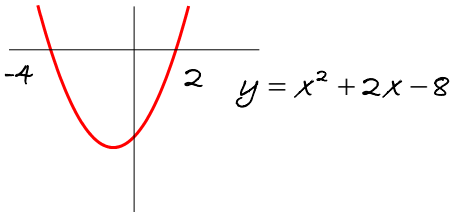
(viii) $x(x + 3) > x + 8$

$x^2 + 3x > x + 8$

$x^2 + 2x - 8 > 0$

$(x + 4)(x - 2) > 0$

From graph, $x < -4$ or $x > 2$

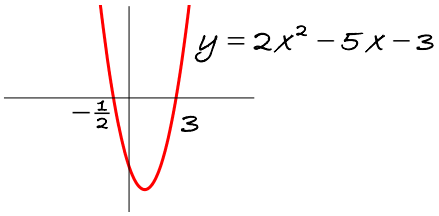


4. (i) $2x^2 - 5x - 3 \leq 0$

$(2x + 1)(x - 3) \leq 0$

From graph, $-\frac{1}{2} \leq x \leq 3$

The integer values are 0, 1, 2, 3



(ii) $x^2 + 2x - 1 < 0$ cannot be factorised, so use quadratic formula to solve the equation $x^2 + 2x - 1 = 0$:

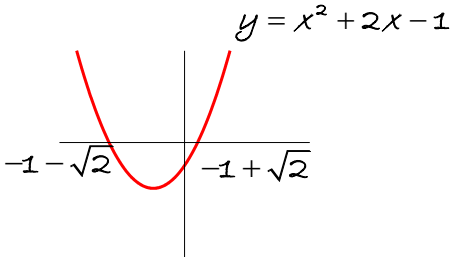
$a = 1, b = 2, c = -1$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-2 \pm \sqrt{2^2 - 4 \times 1 \times -1}}{2}$$

$$= \frac{-2 \pm \sqrt{8}}{2} = \frac{-2 \pm 2\sqrt{2}}{2} = -1 \pm \sqrt{2}$$

From graph, $-1 - \sqrt{2} < x < -1 + \sqrt{2}$

The integer values are -2, -1, 0.



5. $(x + 3)^2 > (x - 1)^2$

$(x + 3)^2 - (x - 1)^2 > 0$

$(2x + 2)(4) > 0$

$x + 1 > 0$

$x > -1$