1. $-2 < x \leq 1$

x is an integer.

Write down all the possible values of x.

....
(Total 2 marks)

2. (a) Simplify

(i) $\frac{x^6}{x^2}$

....

(ii) $(y^4)^3$

....
(2)

(b) Expand and simplify $(t + 4)(t - 2)$

....
(2)

(c) Write down the integer values of x that satisfy the inequality

$$-2 \leq x < 4$$

....
(2)
(Total 6 marks)

3. (a) Solve $5 - 3x = 2(x + 1)$

x = ...

(3)

(b) $-3 \leq y < 3$

y is an integer.

Write down all the possible values of y.

....

(2)

(Total 5 marks)

4. (a) $-3 \leq n < 2$
n is an integer.
Write down all the possible values of n.

....

(2)

(b) Solve the inequality

$$5x < 2x - 6$$

....

(2)

(Total 4 marks)

5. (a) m is an integer such that $-1 \leq m < 4$
List all the possible values of m.

....
(2)

(b) (i) Solve the inequality $3x \geq x + 7$

....

(ii) x is a whole number.
Write down the smallest value of x that satisfies $3x \geq x + 7$

....
(3)
(Total 5 marks)

6. $-6 \leq 2y < 5$

y is an integer.
Write down all the possible values of y.

....
(Total 3 marks)

7. $-2 \leq x < 3$
x is an integer.

Write down all the possible values of x.

....
(Total 2 marks)

8. $-2 < n \leq 4$
n is an integer.

(a) Write down all the possible values of n.

....
(2)

(b) Solve the inequality $6x - 3 < 9$

....
(2)
(Total 4 marks)

9. (a) Solve the inequality $5x + 12 > 2$

……………………………
(2)

(b) Expand and simplify

$(x - 6)(x + 4)$

....

(2)
(Total 4 marks)

10. Solve the inequality $3x + 2 > -7$

....
(Total 2 marks)

11. n is a whole number such that

$$7 \leq 3n < 15$$

List all the possible values of n.

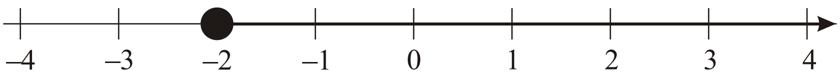
....
(Total 3 marks)

12. (a) Solve the inequality $4x - 3 < 7$

…………………

(2)

An inequality is shown on the number line.



(b) Write down the inequality.

…………………………

(2)
(Total 4 marks)

13. (i) Solve the inequality $7x - 3 > 17$

....

x is a whole number such that $7x - 3 > 17$

(ii) Write down the smallest value of x.

....
(Total 3 marks)

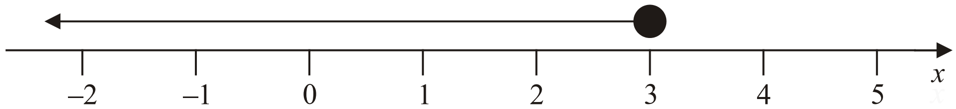
14. (a) Solve the inequality $6x < 7 + 4x$

....
(2)

(b) Expand and simplify $(y + 3)(y + 4)$

....
(2)
(Total 4 marks)

[3] **015.** (i) Write down the inequality shown on the number line.



....

(ii) Show the inequality $x > 1$ on the number line below.

(Total 3 marks)

1. –1, 0, 1 — 2

B2 for –1, 0, 1 only
(B1 for –1, 0 or 0,1 or –1, 1 or –2, -1, 0, 1 only)

[2]

2. (a) (i) x^4 — 1

B1 cao

(ii) y^{12} — 1

B1 cao

(b) $t^2 + 2t – 8$ — 2

B2 for fully correct
(B1 for 3 out of 4 terms from $t^2 + 4t – 2t – 8$)

(c) – 2, –1, 0, 1, 2, 3 — 2

B2 for fully correct
(B1 for –2, –1, 0, 1 , 2, 3 with either –2 omitted or 4 included, or both, or any five integers correct only and no incorrect integers)

[6]

3. (a) $\frac{3}{5}$ 3

$5 - 3x = 2x + 2$
$5 - 2 = 2x + 3x$

B1 for 2x + 2 seen OR 2.5 – 1.5x = x + 1
M1 for correct rearrangement of 4 terms
A1 for $\frac{3}{5}$ *oe*

(b) – 3, – 2, – 1, 0, 1, 2 2

B2 (B1 for 5 correct and not more than one incorrect integers)

[5]

4. (a) –3, –2, –1, 0, 1 2

B2 cao (–1 each error or omission)

(b) $3x < -6$ 2
$x < -2$

M1 for subtracting 2x from both sides, condone sign error in 6 and use of =, >, ≤, ≥
A1 for $x < -2$*, accept* $x < -\frac{6}{3}$

[4]

5. (a) –1, 0, 1, 2, 3 2

B2 cao (–1 each error or omission)

(b) (i) $x \geq \frac{7}{2}$

M1 for $2x \geq 7$, condone use of = sign or wrong equality

A1 for $x \geq \frac{7}{2}$ oe as final answer

(ii) 4 3

SC:B1 for 3.5 or $\frac{7}{2}$ seen if M0

B1 ft from $x \geq$ "$\frac{7}{2}$"

[5]

6. $-3 \leq y < 2.5$ 3

$= -3, -2, -1, 0, 1, 2$

M1 for dividing a list of integers by 2 or for $y \geq -3$ and/or $y < 5/2$ seen or implied

A2 for all integers correct

(A1 for 5 correct with no more than one extra)

[3]

7. –2, –1, 0, 1, 2 2

B2 for –2, –1, 0, 1, 2 cao
(B1 for 4 correct
or for 4 correct and one incorrect
or for 5 correct and one incorrect)

[2]

8. (a) –1, 0, 1, 2, 3, 4 2

B2 cao
(B1 for at least 5 correct and not more than one incorrect integer)

(b) $6x < 9 + 3$

$x < 2$ — 2

M1 for correctly separating x and non x terms or for dividing both sides by 6 [condone use of =, >, ≤, or ≥]

A1 for $x < 2$, accept $x < \frac{12}{6}$

[SC: B1 for $x = 2$ with no working. But 2 on the answer line with no working gets no marks]

[4]

9. (a) $x > -2$ — 2

$5x > 2 - 12$
$x > -10/5$

M1 for process to separate x and non -x terms
A1 cao

(b) $x^2 - 2x - 24$ — 2

$x^2 - 6x + 4x - 24$

M1 for at least 3 correct terms
A1 cao

[4]

10. $x > -3$ — 2

$3x > -9$

M1 for $3x > -7 - 2$
A1 cao

[2]

11. 3, 4 — 3

$\frac{7}{3} \le n < \frac{15}{3}$

B3 for 3, 4 only
(B2 for 3, 4, 5 OR 2, 3, 4, OR $3 \le n < 5$ OR $2 < n < 5$)
(B1 for 2, 3, 4, 5 OR $\frac{7}{3} \le n \le \frac{15}{3}$ OR 3 OR 4 OR 3, 4 and one non-integer)

[3]

12. (a) $x < \frac{10}{4}$ 2

$4x < 10$

M1 for $4x < 7 + 3$ *or* $x - \frac{3}{4} < \frac{7}{4}$

A1

(b) $x \geq -2$ 2

B2 for $x \geq -2$ *(B1 for* $x > -2$, $-2 \leq x < 4$*)*

[4]

13. (i) $7x > 17 + 3$

$7x > 20$

$x > \frac{20}{7}$

$x > \frac{20}{7}$ 3

M1 for $7x > 17 + 3$ *or* $x - \frac{3}{7} > \frac{17}{7}$

A1 for $x > \frac{20}{7}$ *o.e as final answer*

(ii) 3

B1 (f.t. provided M1 scored)

[3]

14. (a) $6x - 4x < 7$

$x < 3.5$ oe 2

M1 for $6x - 4x < 7$

A1 for $x < 3.5$ *as final answer*

(b) $y^2 + 3y + 4y + 12$

$y^2 + 7y + 12$ 2

M1 for at least 3 correct terms

A1 cao

[4]

15. (i) $x \leq 3$ 3

B1 for $x \leq 3$

(ii) Arrow from empty circle

B2 for fully correct solutions
(B1 for two correct of: (i) circle on 1 (ii) unshaded circle (iii) arrow pointing right)

[3]

1. Mathematics A

Paper 3

Most candidates gained at least 1 mark in this question, though attempts were not quite as good as in previous years. There was clear confusion between ≤ and <.

Paper 5

Almost all candidates gained some credit in this inequality question. The main error was the omission of 0. Even some high-grade candidates believed that 0 was not an integer.

Mathematics B

Paper 16

The majority of candidates gained 1 mark here, usually for listing just two possible values of x. –1, 0 and 1 were excluded in even proportion. –2 was often included and only gained a mark if all three of the other integers were quoted.

Paper 18

This question was well done. A minority of candidates incorrectly included the value – 2 in their answer. The value of 0 was often included but then crossed out, possibly indicating that some candidates did not recognise that 0 is an integer.

2. In part (a) more than half of the candidates gained at least one of the two marks. Common incorrect answers were x^3 and y^7. A quarter of candidates managed to obtain three or four correct terms in part (b) but mistakes were often made in multiplying out the brackets. Part (c) was answered quite well. Some candidates omitted –2 from the solution and others included 4.

3. Specification A

Higher Tier

The majority of candidates did well in this question. In part (a), many expanded the brackets successfully but then made mistakes rearranging the terms. A common error was to obtain $x = \frac{5}{3}$ from $3 = 5x$. Most of the candidates got full marks in part (b). Common errors were to omit the 0, include a 3, or to list only the positive integers.

Intermediate Tier

Again it was encouraging to see far fewer attempts at trial and improvement, and far more evidence of attempts at algebraic manipulation. This was frequently rewarded with at least one mark for the first step, but many candidates then failed to correctly rearrange terms. $x = 7$ was seen regularly. Many candidates reached $3 = 5x$, but were confused by the fact that the x was on the right hand side, to the point where they then undertook $\frac{5}{3}$ instead of $\frac{3}{5}$. Candidates were very successful in part (b), with most gaining full marks. The only common error was the omission of a number from the list, usually –3, but sometimes the 2 or the 0.

Specification B

Part (a) Many candidates earned one mark in this question for a correct expansion of the brackets; although $2x + 1$ and $2x + 3$ were common errors. Correctly isolating the terms in x and the number terms proved more demanding and sign errors accounted for the greatest loss of the remaining marks. Candidates should be encouraged to show their working when rearranging equations, often $5 - x = 2$ was seen, without clear indication from where the $-x$ had been derived (sight of $-3x - 2x$ equated to $-x$ could have gained one more mark).
A significant number of candidates correctly rearranged the equation to $5x = 3$ and then proceeded to divide 5 by 3 for their answer. This is a notable change from previous years.
In part (b) predictable errors of omitting the zero and/or including 3 were made.

4. Many candidates gained at least one mark in part (a). The most common errors made by those that understood the question related to the inclusion or exclusion of the endpoints. Some failed to include 0. The term 'integer' was generally understood although a few candidates did include non-integer values. Part (b) was answered very poorly and many candidates wrote little or nothing. It would appear that candidates continue to be put off by the inequality symbol. Even some of those who subtracted $2x$ from both sides did not know what to do with the inequality symbol and either replaced it with '=' or lost it altogether.

5. **Intermediate Tier**

Part (a) was done well by most candidates. A popular error was the omission of 0 or the inclusion of 4. In part (b)(i), most candidates were able to collect the x terms together, but many were confused by the inequality sign and gave their final answer as $x = 3.5$

Many candidates were able to do part (b)(ii) without reference to the preceding part by substituting different values of x into the original inequality. On the other hand, a significant number of candidates, having achieved the correct answer in part (b)(i), gave their final answer as 3.5 in part (b)(ii).

Intermediate Tier

The term ‘integer’ was generally understood and many candidates gained at least one mark in part (a). The most common errors made by those that understood the question related to the inclusion or exclusion of the endpoints. In particular, –1 was often omitted from the list. Part (b) was aimed at the most able candidates and it was not well answered. Many did not attempt it. Few could work with the expression in (i) either as an inequality or as an equation. Candidates were a little more successful in (ii) and correct answers were seen here even when (i) was incorrect or had not been attempted.

6. Only about half the candidates were able to achieve full marks for this question. Most knew that they needed to produce a list of integers, but many did not appreciate the significance of the 2 in $2y$ and hence gave a list of integers from −3 to 2. A common error amongst those candidates producing a list by trial and improvement (a popular method) was to omit the 0.

7. **Foundation**

The term ‘integer’ appeared to be generally understood and many candidates gained at least one mark. The most common error made by those who understood the question was to omit –2 from the list.

Higher

This question was done well. Most candidates were able to give the integer values of x within the range. Common errors were to either to omit an integer (usually 0 or –2) or to add an extra integer (usually 3).

8. Most candidates were able to score at least one mark in part (a) for quoting 5 correct possible integer values of n in the given inequality; the omission of zero or the inclusion of –2 were the usual errors made. In part (b), candidates were less successful, many totally ignoring the inequality and giving $x = 2$ as their answer; this was awarded one mark, for evidence of some correct algebraic manipulation. Some candidates quoted the correct answer $x < 2$ and then gave examples of possible values of x. This extra working was ignored and full marks were awarded.

9. In part (a) the majority of candidates were able to separate the x terms correctly. However, the final accuracy mark was often not gained because candidates gave their final answer to this inequality as either $x = –2$ or just –2.
Part (b) was generally well done. Common errors occurred when candidates either failed to simplify the x terms incorrectly or wrote the independent term as + 24.

10. This question was poorly done, many candidates treating the inequality as an equation, sometimes resulting in an answer of $x = –3$. This gained no marks.
Many candidates wrote $3x$ greater than –5, failing to isolate the term in x correctly. 'Embedded' answers were not acceptable since $3 \times –3 + 2$ is not greater than –7.

11. The majority of candidates were able to gain some marks in this question. It was common to see 5 (and sometimes 2) contained within a list of integers. A number of candidates did not appreciate the need to give integer answers only.

12. **Paper 12**

Few candidates scored full marks in each section, 11% in part (a) and 12% in part (b), and it was not unusual to see no attempt made at either part. In the first part, the inequality was often simplified incorrectly eg $7x < 10$ and $4x < 4$, while $x < 7$ was a popular wrong answer. Only 1 mark was awarded when the correct answer, $x < 2.5$, appeared in the working space if $x = 2.5$ was stated alone on the answer line.
A small number of candidates assumed that x was an integer, usually in both parts.
In the second part, answers of –2 were common, as were $x \leq –2$ and $x \geq 2$. Some created inequalities using – 2 and 4 e.g. $x – 2 < 4$, $4x > –2$ and $–2x \leq 4$.

Paper 13

In part (a) the method was generally well understood by the majority of candidates but a significant number lost the accuracy mark because they did not carry the inequality sign to the answer line or to the last line of their solution.
In part (b), use of a strict inequality was a common error as was the use of the wrong inequality sign. Some candidates incorrectly included an upper limit, usually < 4.

13. Approximately half of the candidates were able to answer part (i) correctly. Candidates should be reminded to ensure that, when solving an inequality, they give their final answer as an inequality. Many candidates converted the given inequality into an equation and thus failed to gain at least one of the two available marks. Candidates who failed to score in part (i) were often able to pick up a mark in (ii).

14. In part (a) the majority of candidates were able to carry out the correct algebraic processes in order to solve the inequality. Not all candidates, however, gave their final answer as an inequality. Candidates should be reminded that solutions to inequalities should always contain the appropriate inequality sign rather than an equal sign. Part (b) was answered correctly by approximately 80% of candidates. The most common error seen was to give 3×4 as 7 rather than 12. Another common error was to expand correctly but then simplify incorrectly, often trying to combine x and x^2 terms.

15. Few candidates demonstrated any secure knowledge of inequalities. Common incorrect answers included "3", and $x < 2$. A minority, perhaps spotting the inequality in (b), gave the answer as $x < 3$ or $x > 3$, but very few understood the significance of the symbol above the 3 in the diagram. In part (b) this misunderstanding continued, with many candidates starting their arrow on 2 (which is of course greater than 1!). Nearly all copied the symbol from (i) without unshading it.