Exercise 1 (A)

1) Draw a Celsius thermometer and mark a scale on it from -10° to +10°. Use your drawing to write the following temperatures as positive or negative numbers: -
   
   a) 10° above freezing point
   b) 7° below freezing point
   c) 3° below zero
   d) 5° above zero
   e) 8° below zero
   f) freezing point.

2) Write down, in words, the meaning of the following temperatures: -
   
   a) –2°C
   b) +3°C
   c) 4°C
   d) –10°
   e) 8°C
   f) 0°C.

3) Which is colder –8°C or –4°C?

4) Is –1°C colder or warmer than –2°C?

5) Which is colder –5°C or –10°C?

6) Which of these temperatures is lowest? –6°C, –4°C, –8°C.

7) Which of these temperatures is highest? –10°C, –2°C, –3°C.

8) Is 4°C higher or lower than –6°C?

9) Here are some pairs of temperatures. Write down the higher temperature of each pair.
   
   a) 0°C, 5°C
   b) 0°C, –5°C
   c) –8°C, –3°C
   d) 12°C, –16°C.
10) What temperature is 5 degrees higher than 2°C?
11) What temperature is 5 degrees lower than 2°C?
12) What temperature is 10 degrees lower than –3°C?
13) What temperature is 10 degrees higher than –3°C?

14) Use positive or negative numbers to describe the following quantities

   a) 5 seconds before blast-off of a rocket.
   b) 5 seconds after blast-off of a rocket.
   c) 50p in your purse.
   d) 50p owed.
   e) 1 minute before the train leaves the station.
   f) A win of £50 on premium bonds.
   g) A debt of £5
   h) Walking forwards 5 paces
   i) Walking backwards five paces
   j) The top of a hill which is 200 m above sea level.
   k) A ball thrown down a distance of 5 m.

15) At midnight the temperature was –2°C. One hour later it was 1°C colder. What was the temperature then?

16) At midday the temperature was 18°C. Two hours later it was 3°C warmer. What was the temperature then?

17) A rock climber started at +200m and came a distance of 50m down the rock face. How far above sea level was he then?
Exercise 2 (A)

1) 2 – 3  
2) 7 – 9  
3) 14 – 19  
4) 12 – 15  
5) 6 – 11  
6) 9 – 16  
7) 18 – 25  
8) 3 – 24  
9) 22 – 38  
10) 39 – 54  
11) 4 – 37  
12) 8 – 47  
13) 58 – 72  
14) 59 – 95  
15) 80 – 138  
16) 243 – 437

Exercise 2 (B)

Find the next two numbers in each sequence.

1) 10, 8, 6, 4  
2) 12, 9, 6  
3) 3, 2, 1, 0, –1  
4) 4, 2, 0, –2  
5) 12, 6, 0  
6) –3, –2, –1  
7) –8, –6, –4  
8) 10, 6, 2  
9) 15, 5, –5  
10) –10, –6, –2  
11) –7, –4, –1  
12) 6, 2, –2  
13) 2, 3, 5, 8  
14) 12, 11, 9, 6  
15) 0, 1, 3, 6  
16) 4, 3, 1, –2  
17) –10, –9, –7, –4  
18) 5, 2, –1, –4  
19) 24, 10, –4  
20) –11, –7, –3

Exercise 3 (A)

Calculate the following

1) 3 + (–2)  
2) 6 + (–4)  
3) 4 + (–7)  
4) 6 + (–6)  
5) 11 + (–9)  
6) 9 + (–10)  
7) 7 + (–16)  
8) –4 + 3  
9) –5 + (–5)  
10) –4 + (–10)  
11) –3 + (–12)  
12) –5 + (–3)  
13) –8 + (–10)  
14) –10 + (–2)  
15) –3 + (–3)  
16) –5 + (–1)  
17) –11 + (–9)  
18) –7 + (–13)  
19) –10 + (–10)  
20) –12 + (–7)  
21) –4 + (–4)  
22) –4 + (–2)  
23) –4 + 4  
24) –9 + (–9)  
25) –2 + 6  
26) –3 + 10  
27) –3 + 1  
28) –5 + 6  
29) –8 + 11  
30) –6 + 1  
31) –3 + 2  
32) –7 + 3  
33) –8 + 1  
34) –7 + 2  
35) –8 + 6  
36) –7 + 10  
37) –6 + 30  
38) –100 + 1  
39) –8 + 38  
40) 5 + (–4)  
41) 7 + (–3)  
42) –10 + (–4)  
43) 6 + (–10)  
44) 8 + (–9)  
45) –8 + (–12)  
46) –5 + (–6)  
47) –6 + (–2)  
48) 8 + (–14)
Exercise 3 (B)

Calculate the following

1) 7 – (–5)  
2) 9 – (–1)  
3) 7 – (–9)  
4) 6 – (–13)  
5) 9 – (–8)  
6) 18 – (–1)  
7) 5 – (–19)  
8) 2 – (–15)  
9) 17 – (–15)  
10) 29 – (–17)  
11) 56 – (–9)  
12) 68 – (–27)  
13) 86 – (–8)  
14) 98 – (–1)  
15) 59 – (–49)  
16) 29 – (–115)  
17) 56 – (–34)  
18) 99 – (–41)  
19) 39 – (–39)  
20) 79 – (–135)  
21) –9 – (–16)  
22) –15 – (–21)  
23) –32 – (–41)  
24) –45 – (–67)  
25) –92 – (–42)  
26) –115 – (–71)  
27) –232 – (–51)  
28) –345 – (–62)  

Exercise 3(C)

Calculate the following

1) 5 + (–2) + 1  
2) 8 + (–6) + 4  
3) 9 + (–2) + (–3)  
4) 12 + (–7) + (–5)  
5) –6 + 3 + 5  
6) –4 + 3 + (–2)  
7) –10 + (–1) + (–2)  
8) 1 + (–2) + (–3)  
9) –6 + (–3) + 5  
10) –4 + (–3) + (–2)  
11) –10 + (–1) + 2  
12) –18 + 21 + (–23)  
13) The table shows ordinary summer and winter temperatures for 8 cities

<table>
<thead>
<tr>
<th>CITY</th>
<th>WINTER TEMPERATURE</th>
<th>SUMMER TEMPERATURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>London</td>
<td>4°C</td>
<td>18°C</td>
</tr>
<tr>
<td>Rome</td>
<td>7°C</td>
<td>25°C</td>
</tr>
<tr>
<td>Moscow</td>
<td>-9°C</td>
<td>18°C</td>
</tr>
<tr>
<td>Johannesburg</td>
<td>10°C</td>
<td>20°C</td>
</tr>
<tr>
<td>New York</td>
<td>-1°C</td>
<td>24°C</td>
</tr>
<tr>
<td>San Francisco</td>
<td>10°C</td>
<td>17°C</td>
</tr>
<tr>
<td>Sydney</td>
<td>11°C</td>
<td>21°C</td>
</tr>
<tr>
<td>Wellington(NZ)</td>
<td>8°C</td>
<td>17°C</td>
</tr>
</tbody>
</table>

a) Which city has the lowest winter temperature?  
b) Which city has the highest winter temperature?  
c) Which cities have the lowest summer temperature?
d) Which city has the highest summer temperature?

e) The temperature in London goes up by 14 degrees between winter and summer. By how many degrees does it go up in:
   i) Rome  
   ii) Moscow  
   iii) New York?

Exercise 4 (A)

1) Write down the coordinates of P, Q, R, S, T, U, V, W and X

2) Draw a set of axes like the ones in question 1.
   a) Plot the points P(0, 6), Q(0, 2) and R(6, 2). Join P to Q and Q to R.
   b) P, Q and R are three corners of rectangle PQRS. Plot the fourth corner S
   c) Write down the coordinates of S.
   d) Draw the diagonal lines PR and QS.
   Mark the point where these lines cross and call the point T.
   e) Write down the coordinates of T.
3) Draw a set of axes like the ones in question 1.
   a) Plot the points A(3, 1), B(1, 5) and C(3, 6). Join A to B and B to C.
   b) A, B and C are three corners of rectangle ABCD. Plot the fourth corner D.
   c) Write down the coordinates of D.
   d) Plot the point which is at the centre of the rectangle. Call this point E.
   e) Write down the coordinates of E.

4) Copy and complete the table below using the diagram.

<table>
<thead>
<tr>
<th>Name of shape</th>
<th>Coordinates of the corners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kite ABCD</td>
<td>A(2, 2) B( , ) C( , ) D( , )</td>
</tr>
<tr>
<td>..............EFGH</td>
<td>E( , )</td>
</tr>
</tbody>
</table>

![Diagram showing various shapes with labeled vertices.]
5) Write down the coordinates of all the points shown in the diagram below.
6) Copy and complete the table below using the diagram below.

<table>
<thead>
<tr>
<th>Name of shape</th>
<th>Coordinates of the corners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Square ABCD</td>
<td>A(4, 2) B( , ) C( , ) D( , )</td>
</tr>
<tr>
<td>...............EFGH</td>
<td>E( , )</td>
</tr>
</tbody>
</table>

![Diagram of geometric shapes with coordinates indicated on the grid.](image-url)
For the following questions draw your own set of axes and scale each one from –5 to 5.

7) Plot the points A(–3, 4), B(–1, 4), C(1, 3), D(1, 2), E(–1, 1), F(1, 0), G(1, –1), H(–1, –2), I(–3, –2).
   Join the points in alphabetical order and join I to A.

8) Plot the points A(4, –1), B(4, 2), C(3, 3), D(2, 3), E(2, 4), F(1, 4), G(1, 3), H(–2, 3), I(–3, 2), J(–3, –1).
   Join the points in alphabetical order and join J to A.

9) Plot the points A(2, 1), B(–1, 3), C(–3, 0), D(0, –2).
   Join the points to make the figure ABCD. What kind of shape is this figure?

10) Plot the points A(1, 3), B(–1, –1), C(3, –1).
    Join the points to make the figure ABC and describe ABC.

11) Plot the points A(–2, –1), B(5, –1), C(5, 2), D(–2, 2).
    Join the points to make the figure ABCD and describe ABCD.

12) Plot the points A(–3, 0), B(1, 3), C(0, –4).
    What kind of triangle is ABC?
Exercise 4(B)

1) Draw a set of axes running from –8 to 8 in each direction.

Plot these sets of points in your jotter joining them up as you go:

a) \((-7, 3) \rightarrow (-7, 5) \rightarrow (-6, 4) \rightarrow (-5, 5) \rightarrow (-5, 3)\)

b) \((-4, 3) \rightarrow (-3, 5) \rightarrow (-2, 3)\)

c) \((-3\frac{1}{2}, 4) \rightarrow (-2\frac{1}{2}, 4)\)

d) \((-2, 5) \rightarrow (0, 5)\)

e) \((-1, 5) \rightarrow (-1, 3)\)

f) \((1, 5) \rightarrow (1, 3)\)

g) \((1, 4) \rightarrow (3, 4)\)

h) \((3, 5) \rightarrow (3, 3)\)

i) \((6, 5) \rightarrow (4, 5) \rightarrow (4, 4) \rightarrow (6, 4) \rightarrow (6, 3) \rightarrow (4, 3)\)

j) \((-1, 1) \rightarrow (-1, -1)\)

k) \((2, 1) \rightarrow (0, 1) \rightarrow (0, 0) \rightarrow (2, 0) \rightarrow (2, -1) \rightarrow (0, -1)\)

l) \((-2, -3) \rightarrow (-4, -3) \rightarrow (-4, -5)\)

m) \((-4, -4) \rightarrow (-2, -4)\)

n) \((-1, -3) \rightarrow (-1, -5) \rightarrow (1, -5) \rightarrow (1, -3)\)

o) \((2, -5) \rightarrow (2, -3) \rightarrow (4, -5) \rightarrow (4, -3)\)

What sentence does this make?
2) Draw a set of x, y axes extending 4 units in all 4 directions.
   a) Plot these points, and join them up:
      (3, 0), (1, 1), (0, 3), (–1, 1), (–3, 0), (–1, −1), (0, −3), (1, −1), (3, 0).
   b) Describe the shape you have drawn.
   c) What are the coordinates of its centre?

3) A rectangular area is roped off for study.
   Three of its vertices are at (–2, 2), (6, –2) and (4, –6).
   Plot these points on an x, y diagram (extending 6 units in all 4 directions),
   and complete the rectangle.
   Write down the coordinates of:
   a) the fourth vertex
   b) the centre of the rectangle
   c) the mid points of its sides.

For the next 10 questions plot the points A & B
and then find the length of the line AB

4) A (2, 2), B (–4, 2)  
5) A (–2, –1), B (6, –1)  
6) A (–4, –4), B (4, 2)  
7) A (1, –6), B (1, –8)  
8) A (3, 2), B (5, 2)  
9) A (5, –1), B (5, 6)  
10) A (–2, 4), B (–7, 4)  
11) A (–1, –2), B (–8, –2)  
12) A (–3, 5), B (–3, –6)  
13) A (–2, –4), B (–2, 7)  

For the next 10 questions the points A, B and C are three corners of a
square ABCD. Plot the points, find D and state the coordinates of D.

14) A (1, 1), B (1, –1), C (–1, –1)  
15) A (1, 3), B (6, 3), C (6, –2)
16) A (3, 3), B (3, –1), C (–1, –1)  
17) A (–2, –1), B (–2, 3), C (–6, 3)
18) A (–5, –3), B (–1, –3), C (–1, 1)  
19) A (–3, –1), B (–3, 2), C (0, 2)
20) A (0, 4), B (–2, 1), C (1, –1)  
21) A (1, 0), B (3, 2), C (1, 4)
22) A (–2, –1), B (2, –2), C (3, 2)  
23) A (–3, –2), B (–5, 2), C (–1, 4)
For questions 24–33 plot the points A, B and hence find C, the midpoint of the line AB.
State the coordinates of C.
Once you have tried the first 2 examples see if you can find out how to find the coordinates of C without drawing a diagram.

24) A(2, 2), B(6, 2)  
25) A(2, 3), B(2, –5)  
26) A(–1, 3), B(–6, 3)  
27) A(–3, 5), B(–3, –7)  
28) A(–1, –2), B(–9, –2)  
29) A(2, 1), B(6, 2)  
30) A(2, 1), B(–4, 5)  
31) A(–7, –3), B(5, 3)  
32) A(–3, 3), B(3, –3)  
33) A(–7, –3), B(5, 3)

Exercise 4(C)

1) The table below gives the names of various quadrilaterals. You are also given three of the four vertices. In each part:

a) draw the quadrilateral (each one on a separate diagram)

b) find the coordinates of the fourth vertex.

<table>
<thead>
<tr>
<th>Quadrilateral</th>
<th>Vertices</th>
<th>Coordinates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Square ABCD</td>
<td>A(1, 3), B(3, –1), C(–1, –3)</td>
<td></td>
</tr>
<tr>
<td>Rectangle EFGH</td>
<td>E(–5, 2), F(4, 5), G(6, –1)</td>
<td></td>
</tr>
<tr>
<td>Rhombus JKLM</td>
<td>J(–2, 4), K(3, 1), L(–2, –2)</td>
<td></td>
</tr>
<tr>
<td>Rhombus NPQR</td>
<td>N(–2, 1), P(–3, –4), Q(2, –3)</td>
<td></td>
</tr>
<tr>
<td>Kite STUV</td>
<td>S(–3, 3), T(–1, 2), U(–3, –4)</td>
<td></td>
</tr>
<tr>
<td>Kite WXYZ</td>
<td>W(–2, –5), X(–2, –1), Y(5, 2)</td>
<td></td>
</tr>
<tr>
<td>Parallelogram ABCD</td>
<td>A(–6, –3), B(–3, 3), C(7, 3)</td>
<td></td>
</tr>
<tr>
<td>Parallelogram EFGH</td>
<td>E(–1, 2), F(–4, –1), G(1, –2)</td>
<td></td>
</tr>
<tr>
<td>Parallelogram EGHF</td>
<td>same coordinates as (h)</td>
<td></td>
</tr>
<tr>
<td>Parallelogram EGFH</td>
<td>same coordinates as (h)</td>
<td></td>
</tr>
</tbody>
</table>
2) Draw a set of x, y axes extending 8 units in all 4 directions.
Plot the following points on the diagram. DO NOT JOIN UP THE POINTS
A(5, 6), B(−3, 6), C(−3, 0), D(−8, 0), E(−8, −6), F(5, −6),
G(0, −6), H(5, 1½), J(½, 1½), K(½, −3)

a) Write down the following distances:
   AB, BC, CD, DE, EF, FG, FH, AH, HJ, JK, DO, OG.

b) How far is
   i) A from the x-axis
   ii) A from the y-axis
   iii) C from the y-axis
   iv) G from the x-axis
   v) H from the x-axis
   vi) H from the y-axis
   vii) E from the y-axis
   viii) J from the x-axis?

c) Is there any point in the diagram which is the same distance from the x
   and y-axes?

d) Write down the coordinates of any point (not in this diagram) which is
   the same distance from both axes.

3) A is the point (−4, 2) and C is the point (2, 2).
   AC is a diagonal of square ABCD.

   a) Find the coordinates of B and D. (B is above D)
   b) Write down the length of both diagonals.
   c) Write down the coordinates of the mid points of CD and AB.

4) P is the point (−3, 1) and R is the point (2, −4).
   PR is a diagonal of square PQRS.

   a) Find the coordinates of Q and S. (Q is above S)
   b) Work out the perimeter of the square.
   c) Write down the coordinates of the mid points of PS and PQ.
Questions 5 & 6 refer to the diagram below

5) Air traffic control must know the positions of aircraft at all times, so it makes use of radar and a coordinate grid. The control tower is at the origin.

   a) Which plane is the same distance from the tower as the Airbus at A(2, 3)?

   b) The Boeing 747 at B(.....,......) is twice the distance from the tower as .......

      What goes in the blank spaces?

   c) Which plane has the same x–coordinate as the Cessna at C?

   d) The DC–9 is due west of the tower. State its coordinates.

   e) Three other planes lie North, South, East or West of the tower:

      – the Eagle, the Foxbat and the Jaguar.

      Identify each and give its coordinates.

   f) Which two planes are just as far apart as the Gulfstream and the tower?
6) After some time these are the positions of the aircraft.

a) Write down the coordinates of each plane

b) List the planes which are:
   
   i) closer to the tower than before
   
   ii) further away from the tower than before
   
   iii) still at the same distance from the tower.

c) Which plane is travelling
   
   i) fastest
   
   ii) slowest?