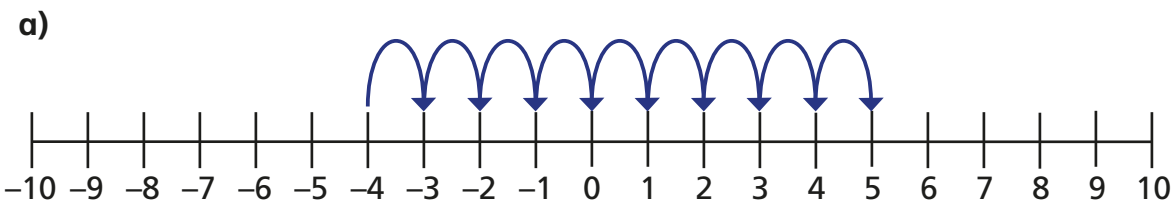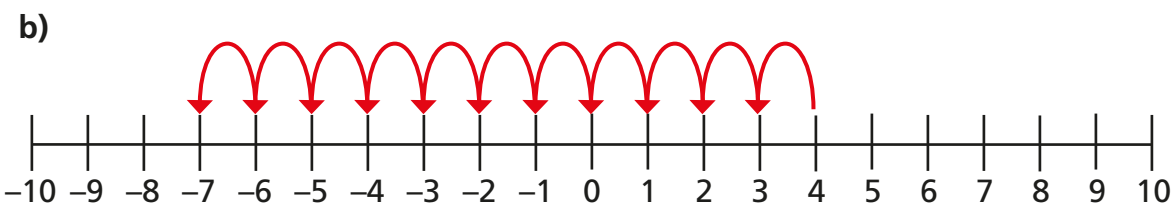# Perform calculations that cross zero

**1** Complete the calculations represented on the number lines.
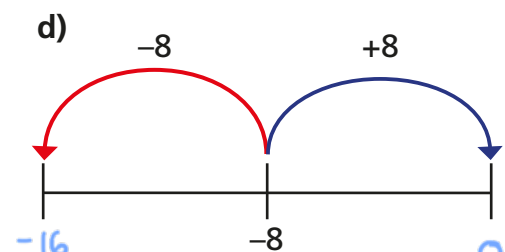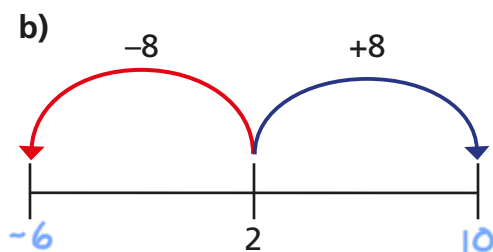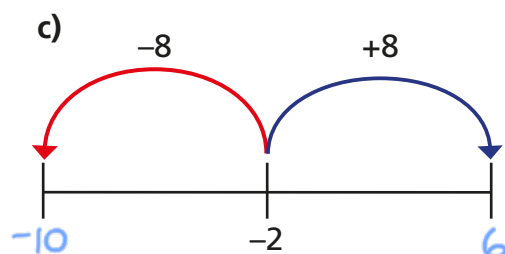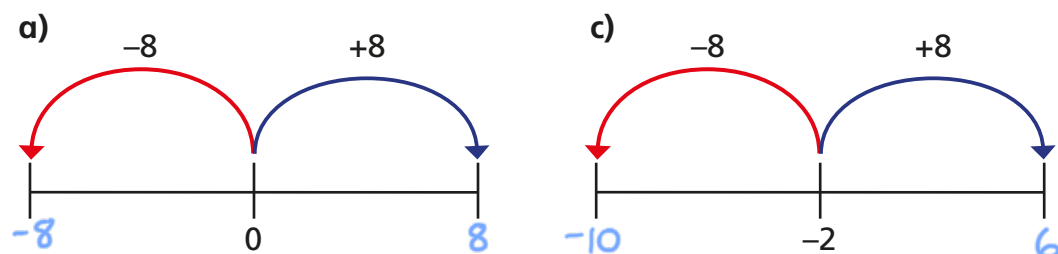
a)



−10 −9 −8 −7 −6 −5 −4 −3 −2 −1 0 1 2 3 4 5 6 7 8 9 10

−4 + $\boxed{9}$ = 5

b)



−10 −9 −8 −7 −6 −5 −4 −3 −2 −1 0 1 2 3 4 5 6 7 8 9 10

4 − $\boxed{11}$ = $\boxed{-7}$

**2** Fill in the missing numbers on the number lines.

a)

−8        +8

$\boxed{-8}$        0        $\boxed{8}$

b)

−8        +8

$\boxed{-6}$        2        $\boxed{10}$

c)

−8        +8

$\boxed{-10}$        −2        $\boxed{6}$

d)

−8        +8

$\boxed{-16}$        −8        $\boxed{0}$

**3** Tommy is finding 7 less than 3



−10 −9 −8 −7 −6 −5 −4 −3 −2 −1 0 1 2 3 4 5 6 7 8 9 10
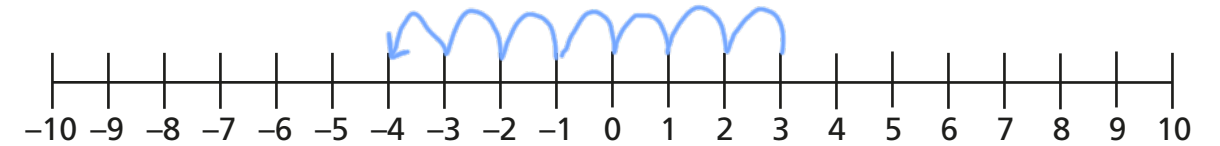
Show how you can use the number line to get the answer.

Discuss your method with a partner.

**4** Complete the calculations.

−10 −9 −8 −7 −6 −5 −4 −3 −2 −1 0 1 2 3 4 5 6 7 8 9 10

a) 7 − 5 = $\boxed{2}$          e) −3 − 5 = $\boxed{-8}$

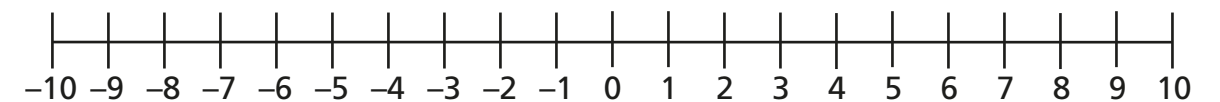b) 5 − 7 = $\boxed{-2}$          f) −8 + 2 = $\boxed{-6}$

c) −5 + 7 = $\boxed{2}$          g) −2 + 10 = $\boxed{8}$

d) −7 + 5 = $\boxed{-2}$          h) $\boxed{9}$ = −3 + 12

**5** Complete the number sentences.

a) 5 − 9 = $\boxed{-4}$          −5 − 9 = $\boxed{-14}$          −5 + 9 = $\boxed{4}$

b) 1 − $\boxed{8}$ = −7          −1 − $\boxed{6}$ = −7          −1 + $\boxed{8}$ = 7

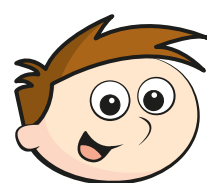c) −28 = $\boxed{-12}$ −16          −28 = $\boxed{-44}$ + 16          28 = $\boxed{44}$ − 16

d) −4 + 34 − 43 = $\boxed{-13}$          102 = −9 + $\boxed{111}$

$\boxed{-20}$ = − 59 − 7 + 46

**6** Teddy is working out the answer to 2 less than negative 3

The answer is negative 1

What mistake has Teddy made?

What is the correct answer? $-5$

**7** The table shows the temperature in five cities at 12 midnight.

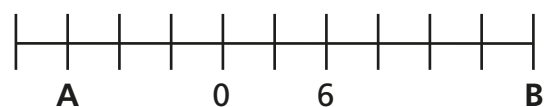| City | Temperature |
|---|---|
| Moscow | −15 °C |
| New York | −6 °C |
| London | 3 °C |
| Paris | 8 °C |
| Dubai | 22 °C |

a) The temperature in Moscow rises by 8 °C by 12 noon.

What is the temperature at 12 noon? $-7$ °C

b) The temperature in London drops by 7 °C.

What is the new temperature? $-4$ °C

c) The temperature in New York at 12 noon is 6 °C.

By how many °C has the temperature risen? $12$ °C

**8** Find the difference between A and B.

A    0   6     B

$27$

**9** Find the missing terms in the linear sequences.

a) −10, −7, −4, $-1$ , $2$ , $5$

b) 9, 2, $-5$ , $-12$ , $-19$

c) −19, −24, $-29$ , $-34$ , $-39$ , −44

d) −2, $-1.5$ , $-1$ , −0.5, $0$ , $0.5$ , $1$

**10** Simplify the expressions by collecting like terms.

a) $3a - 7a \equiv$ $-4a$

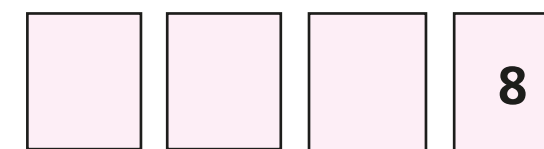d) $-7e - 13e - 2e \equiv$ $-22e$

b) $4b - 5b - 5b \equiv$ $-6b$

e) $8g - g + 9h - 8g - 9h \equiv$ $-g$

c) $0.5d - d \equiv$ $-0.5d$

f) $-2.3k + 3k \equiv$ $0.7k$

**11** Four numbers are put in ascending order.

| | | | 8 |
|---|---|---|---|

- The difference between the largest and smallest number is 11
- The total of the 4 cards is 10

a) Find the three missing numbers. $-3$ , $1$ , $4$

b) How many different solutions can you find?

# Add directed numbers

**1**  🔴 −1 = −1 and 🟡 1 = 1

What is the total value of each set of counters?

**a)** 🔴−1 🟡1

**0**

**b)** 🔴−1 🟡1 🔴−1 🔴−1 🟡1 🔴−1 🟡1

**−1**

**c)** 🟡1 🟡1 🔴−1 🟡1 🔴−1 🟡1 🔴−1

**1**

**d)** 🔴−1 🔴−1 🔴−1 🔴−1 🔴−1 🔴−1 🔴−1
🟡1 🟡1 🟡1 🟡1 🟡1 🟡1 🟡1

**0**

**e)** 🟡1 🔴−1 🔴−1 🔴−1 🟡1 🔴−1 🟡1 🔴−1 🔴−1 🟡1 🔴−1 🔴−1 🟡1 🔴−1 🟡1 🟡1 🔴−1 🟡1 🟡1

**−2**

**2**  Complete the calculations using counters.

**a)** 🟡1 🟡1 🟡1
🔴−1 🔴−1 🔴−1 🔴−1 🔴−1

$3 + -5 = \boxed{-2}$

**b)** 🟡1 🟡1 🟡1 🟡1 🟡1
🔴−1 🔴−1 🔴−1

$\boxed{5} + -3 = \boxed{2}$

**c)** 🟡1 🟡1
🔴−1 🔴−1 🔴−1 🔴−1 🔴−1 🔴−1 🔴−1

$2 + \boxed{-7} = \boxed{-5}$

**d)** 🟡1 🟡1 🟡1 🟡1 🟡1
🔴−1 🔴−1

$-2 + \boxed{5} = \boxed{3}$

**3**  Complete the calculations.

Use counters to help you.

**a)** $2 + -7 = \boxed{-5}$

**c)** $-2 + 7 = \boxed{5}$

**b)** $-8 + 3 = \boxed{-5}$

**d)** $-4 + -3 = \boxed{-7}$

**4**  Use the counters to help you work out $-2 + -6$

🔴−1 🔴−1 + 🔴−1 🔴−1 🔴−1 🔴−1 🔴−1 🔴−1 $= \boxed{-8}$

**5** Complete the calculations.

a) $8 + -3 = \boxed{5}$

$-8 + -3 = \boxed{-11}$

$3 + -8 = \boxed{-5}$

$-3 + -8 = \boxed{-11}$

b) $6 = 7 + \boxed{-1}$
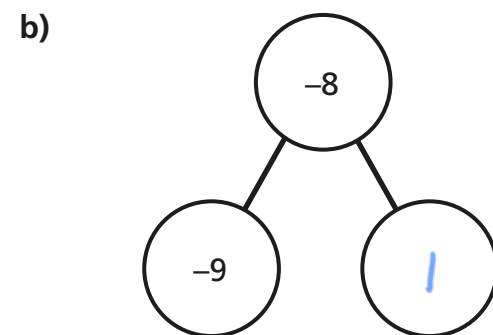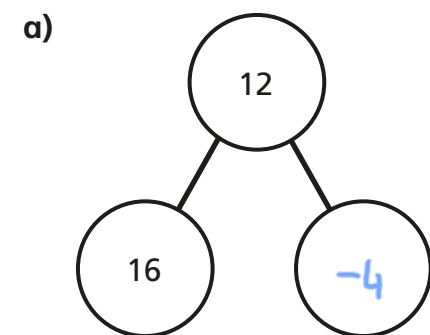
$-6 = 7 + \boxed{-13}$

$6 = -7 + \boxed{13}$

$-6 = -7 + \boxed{1}$

**6** Complete the part-whole models.

a)

12

16    −4

b)

−8

−9    1

**7** Work out the missing numbers in these statements.

a) $4 + -9 = 2 + \boxed{-7}$

c) $9 + -4 = -7 + \boxed{12}$

b) $\boxed{-12} - 1 = -4 + -9$

d) $-7 + \boxed{-6} = -9 + -4$

**8** a) Complete the calculation.

$372 + -408 = \boxed{-36}$

Show your workings.

Compare your method with a partner's.

b) Work out the calculations.

$20 + -35 = \boxed{-15}$

$-10 + -32 = \boxed{-42}$

$\boxed{-5} = 25 + -30$

$291 + -527 = \boxed{-236}$

$-291 + -527 = \boxed{-818}$

**9** In a quiz, you receive 7 points for a correct answer and −4 points for an incorrect answer.

You receive 0 points if you do not answer the question.

There are 20 questions in total.

Is it possible to get a score of −11 in this quiz?  _Yes_

Explain your answer.

_3 correct answers, 8 incorrect answers and 9 unanswered_

_21 + -32 + 0 = -11_

**10** Simplify the expressions by collecting like terms.

a) $6m + -10m \equiv \boxed{-4m}$

b) $-6m + -10m \equiv \boxed{-16m}$

c) $-6m + 10m \equiv \boxed{4m}$

d) $-6m + -10m + 12m \equiv \boxed{-4m}$
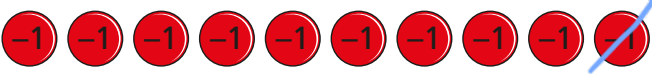
e) $6m + -10m + -17m \equiv \boxed{-21m}$

f) $-6m + 10m + -24m \equiv \boxed{-20m}$

# Subtract directed numbers

**1** What is the total value when one counter is removed from each set?

Complete the calculations.

**a)** −1 −1 −1 ~~−1~~

$-4 - (-1) =$ **−3**

**b)** −1 −1 −1 −1 −1 −1 ~~−1~~

$-7 - (-1) =$ **−6**

**c)** −1 −1 −1 −1 −1 −1 −1 −1 −1 ~~−1~~

$-10 - (-1) =$ **−9**

Discuss what happens with a partner.

**2** Complete the calculations.

Use counters to help you.

−1 −1 −1 −1 −1

**a)** $-5 - (-1) =$ **−4**     **c)** $-5 - (-3) =$ **−2**
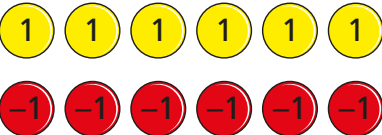
**b)** $-5 - (-2) =$ **−3**     **d)** $-5 - (-5) =$ **0**

**3** What is the total value of the set of counters?

1 1 1 1 1 1     total = **0**
−1 −1 −1 −1 −1 −1

**4** What is the total value of each set of counters?

1 1 1          1 1 1 1          1 1 1 ~~1~~ 1 ✓
                    −1                  −1 −1
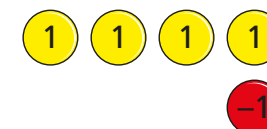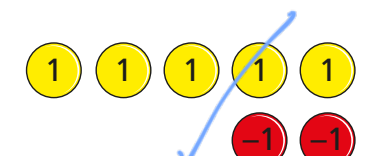
**3**                **3**                **3**

Tick the set of counters that will help you to work out the answer to $3 - (-2)$

Explain your choice.

There are 2 negative counters to take away.

Complete the calculation. $3 - (-2) =$ **5**

**5** Complete the calculations.

$3 - (-1) =$ **4**

$3 - (-3) =$ **6**

$3 - (-4) =$ **7**

Talk about your answers with a partner.

**6** Complete the sequence of subtractions.

4 – 4 = 0          4 – (–1) = 5

4 – 3 = 1          4 – (–2) = 6

4 – 2 = 2          4 – (–3) = 7

4 – 1 = 3          4 – (–4) = 8

4 – 0 = 4

What do you notice?

**7** Brett says –5 – 4 = 9

What mistake do you think Brett has made?

He has seen two negatives and wrongly assumed they make a positive. –5 – 4 = –9

**8** Work out the calculations.

a) 0 – 7 = –7          f) 0 – (–7) = 7

b) 2 – 7 = –5          g) –2 – 7 = –9

c) 2 – (–7) = 9        h) –2 – (–7) = 5

d) 3 – (–5) = 8        i) –10 – 3 = –13

e) –5 = –7 – (–2)      j) –10 – (–3) = –7

**9** Work out the missing numbers.

a) 8 – 19 = –11          e) 11 = 8 – –3

b) –8 – 3 = –11          f) 11 = –8 – –19

c) 8 – 3 = 5             g) –5 = 8 – 13

d) –8 – –13 = 5          h) –5 = –8 – –3

**10** Work out the missing numbers.

a) –4 – (–13) = 7 – –2        c) –16 – 4 = –7 – 13

b) –13 – 4 = –24 – (–7)       d) –7 – 2 = –13 – (–4)

**11** Find pairs of numbers to complete the statements.

e.g.

a) 8 – (–9) = 20 – 3

b) 4 – 3 = –8 – (–9)

c) –9 – –9 = –8 – (–8)

How many different solutions can you find?

**12** Class 7A recorded the temperature during winter every day.

| Day | Temperature (°C) |
|-----|------------------|
| Monday | –6 |
| Tuesday | –3 |
| Wednesday | 1 |
| Thursday | –4 |
| Friday | 2 |
| Saturday | –2 |

What is the range of the temperatures?

8°C

# Multiplication and division of directed numbers

**1** Use the diagrams to help you fill in the missing numbers.

**a)** (−1) (−1) (−1) (−1) (−1) (−1) (−1) (−1)

$-8 \div 2 = \boxed{-4}$ and $-8 \div 4 = \boxed{-2}$

**b)** (−1) (−1) (−1) (−1) (−1)
(−1) (−1) (−1) (−1) (−1)

$-10 \div 2 = \boxed{-5}$ and $-10 \div 5 = \boxed{-2}$

**c)** (−1) (−1) (−1) (−1) (−1) (−1)
(−1) (−1) (−1) (−1) (−1) (−1)
(−1) (−1) (−1) (−1) (−1) (−1)

$-18 \div 3 = \boxed{-6}$ and $-18 \div 6 = \boxed{-3}$

**2** Write two multiplications and two divisions represented by this array.

(−1) (−1) (−1) (−1) (−1)
(−1) (−1) (−1) (−1) (−1)
(−1) (−1) (−1) (−1) (−1)

$\boxed{3} \times \boxed{-5} = \boxed{-15}$     $\boxed{-15} \div \boxed{3} = \boxed{-5}$

$\boxed{5} \times \boxed{-3} = \boxed{-15}$     $\boxed{-15} \div \boxed{5} = \boxed{-3}$

**3** Use the bar models to help you complete the calculations.

**a)** $-4 \times \boxed{3} = \boxed{-12}$

| −4 | −4 | −4 |
|---|---|---|
| −12 | | |

$3 \times \boxed{-4} = \boxed{-12}$

$-12 \div \boxed{3} = \boxed{-4}$

$-12 \div \boxed{-4} = \boxed{3}$
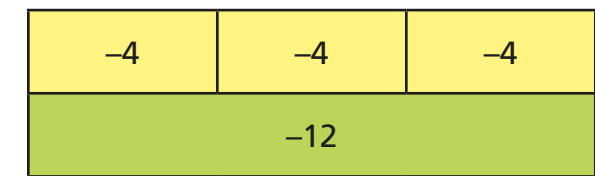
**b)** $\boxed{-18} \div \boxed{6} = \boxed{-3}$

| −18 | | | | | |
|---|---|---|---|---|---|
| −3 | −3 | −3 | −3 | −3 | −3 |

$\boxed{-18} \div \boxed{-3} = \boxed{6}$
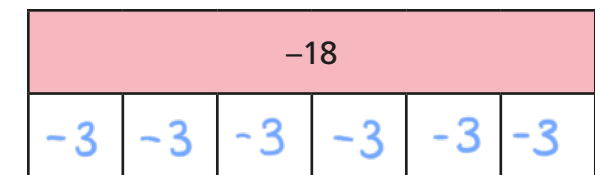
**4**
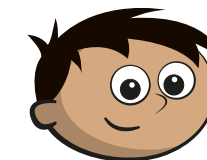
$-5 \times -3 = 15$

Use Amir's multiplication to work out the calculations.

$15 \div -3 = \boxed{-5}$     $15 \div -5 = \boxed{-3}$

**5** Complete the divisions.

$-3 \div 1 = \boxed{-3}$          $-3 \div -1 = \boxed{3}$

$-2 \div 1 = \boxed{-2}$          $-2 \div -1 = \boxed{2}$

$-1 \div 1 = \boxed{-1}$          $-1 \div -1 = \boxed{1}$

$0 \div 1 = \boxed{0}$          $0 \div -1 = \boxed{0}$

What do you notice?

**6** Complete the divisions.

a) $-7 \div -1 = \boxed{7}$

b) $-8 \div -1 = \boxed{8}$

c) $-8 \div -2 = \boxed{4}$

d) $-30 \div -6 = \boxed{5}$

**7** Work out the calculations.

a) $-3 \times -7 = \boxed{21}$  $-3 \times 7 = \boxed{-21}$

$21 \div -7 = \boxed{-3}$  $-21 \div -3 = \boxed{7}$

b) $-10 \times -13.4 = \boxed{134}$  $-13.4 \times 10 = \boxed{-134}$

$134 \div -10 = \boxed{-13.4}$  $-134 \div -13.4 = \boxed{10}$

**8** Work out the value of each calculation and write them in ascending order.

| $-4 \times 8$ | $-8 \div -4$ | $-8 \times -4$ | $8 \div -4$ |
|---|---|---|---|
| -32 | 2 | 32 | -2 |

$-4 \times 8, \quad 8 \div -4, \quad -8 \div -4, \quad -8 \times -4$

**9** Fill in the missing numbers.

a) $\boxed{36} \div -3 = -12$

b) $12 \div \boxed{-1} = -12$

c) $-4.5 = \boxed{-9} \div 2$

d) $60 = \boxed{-360} \div -6$

e) $2 = -3 \div \boxed{-1.5}$

f) $\overset{e.g}{\boxed{32}} \div -8 = 24 \div \boxed{-6}$

**10** In the pyramids, each number is the product of the two numbers below it.

Fill in the missing numbers.

a)

|  | -72 |  |
|---|---|---|
| -6 | 12 |  |
| 3 | -2 | -6 |

b)

|  | 80 |  |
|---|---|---|
| -10 | -8 |  |
| 10 | -1 | 8 |
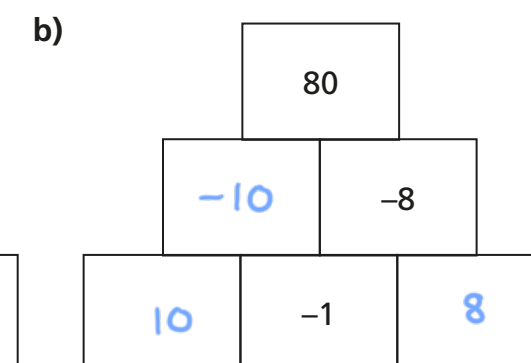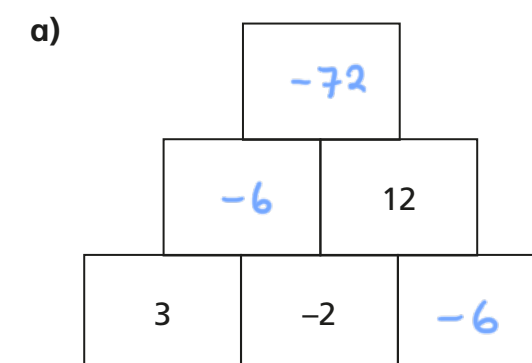
**11** Mo has five number cards.

Here is some information about his number cards.

- The cards are in ascending order.
- The range of the number cards is 32
- The greatest number divided by the median number is 8
- The three numbers in the middle have a product of –36

What could Mo's number cards be?

e.g. $\boxed{-8}$ $\boxed{-2}$ $\boxed{3}$ $\boxed{6}$ $\boxed{24}$

Compare answers with a partner.

How many different solutions can you find?