Problem 1:
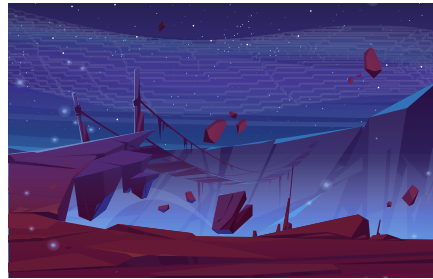
Four friends come to a bridge at night. They have one torch, and the bridge can take two people at a time. The torch must be brought back by someone each time that two people cross.
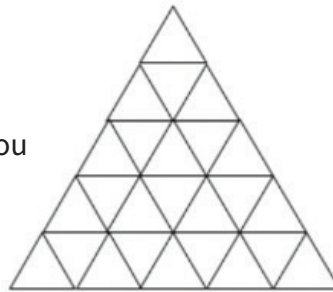
Mere takes 1 minute to cross by herself, Len takes 2 minutes, Fatu takes 7 minutes and Mei takes 10 minutes.

What is the shortest time it takes for all four friends to cross?

Problem 2:

How many equilateral triangles of any size can you find in this figure?

Problem 3:

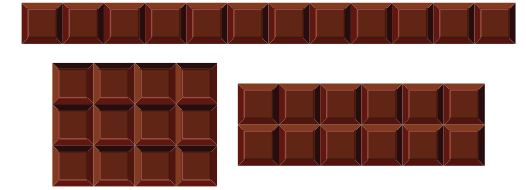Anusha is 25 years older than her son Prakash. They share the same birthday.

In 20 years she will be twice as old as Prakash.

How old is Anusha now?

Composites and primes:

This diagram shows the rectangular chocolate blocks that can be made with 12 squares.

What are the factors of 12?
Why are there only three possible rectangles?

There is only one possible block made with 13 squares.
Why is only one rectangle possible?

12 is a composite number because it has more than two factors.
13 is a prime number because it has only two factors, itself and one.

How many different rectangular blocks can be made with these numbers of chocolate squares? (Remember that a square is a kind of rectangle)
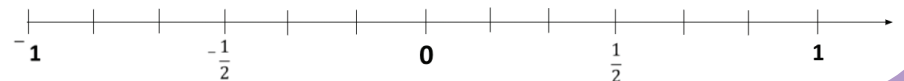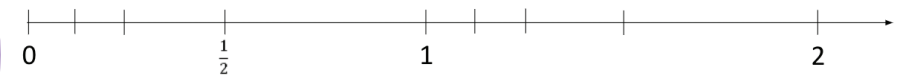
16 squares   17 squares   18 squares

Are the numbers 16, 17, and 18 composites or primes?
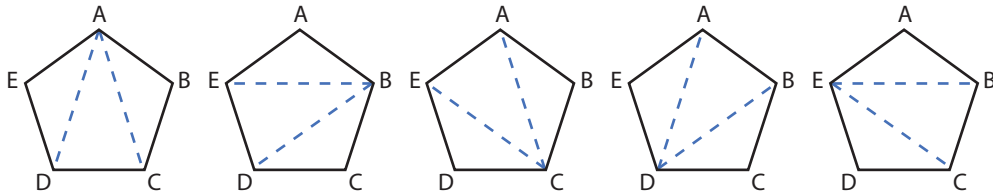
Placing numbers:
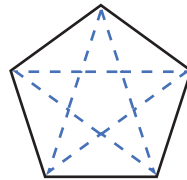
Write the missing numbers on these number lines.

0          $\frac{1}{2}$ 1   2

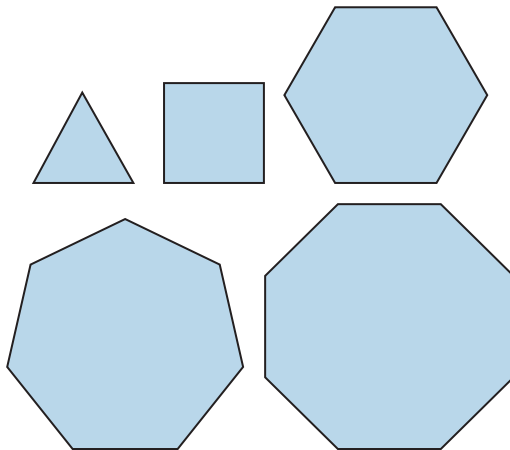$^-1$ $-\frac{1}{2}$ 0 $\frac{1}{2}$ 1

Diagonals:

A diagonal is a line that goes from a corner of a shape to any opposite corner. Here is how you might draw all the diagonals of a regular pentagon.

When you are finished the pentagon looks like this: Why are there only five diagonals, not ten?

Draw all the diagonals for these polygons.

Predict the number of diagonals for a nonagon (9-sided polygon).

Shadows:

You might notice that your shadow changes length and direction as the day passes.

What causes you to have a shadow?

Mark an x on the lawn at home. Stand on that spot every hour of the day, that is: 9:00am, 10:00am, 11:00am, etc.

Put a stone or other marker on the ground where the top of your shadow is. By the end of the day you should have at least 12 markers.

For each marker find out:
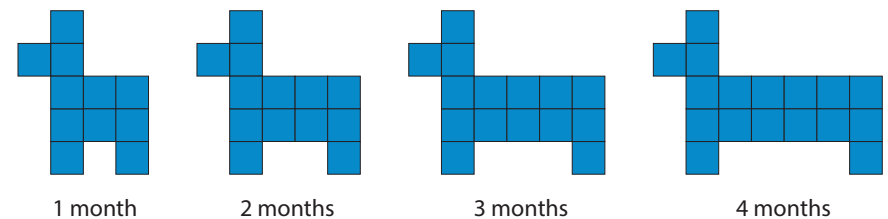- The length of your shadow in centimetres.
- The compass direction of your shadow, e.g., South-east.

Is there a pattern to the way your shadow changes?

Pattern finding:

Here is a pattern showing how Schnitzel, the dachshund, grew in his first four months.

1 month   2 months   3 months   4 months

If Schnitzel kept growing like this, how old was he when he was made up of 39 squares?
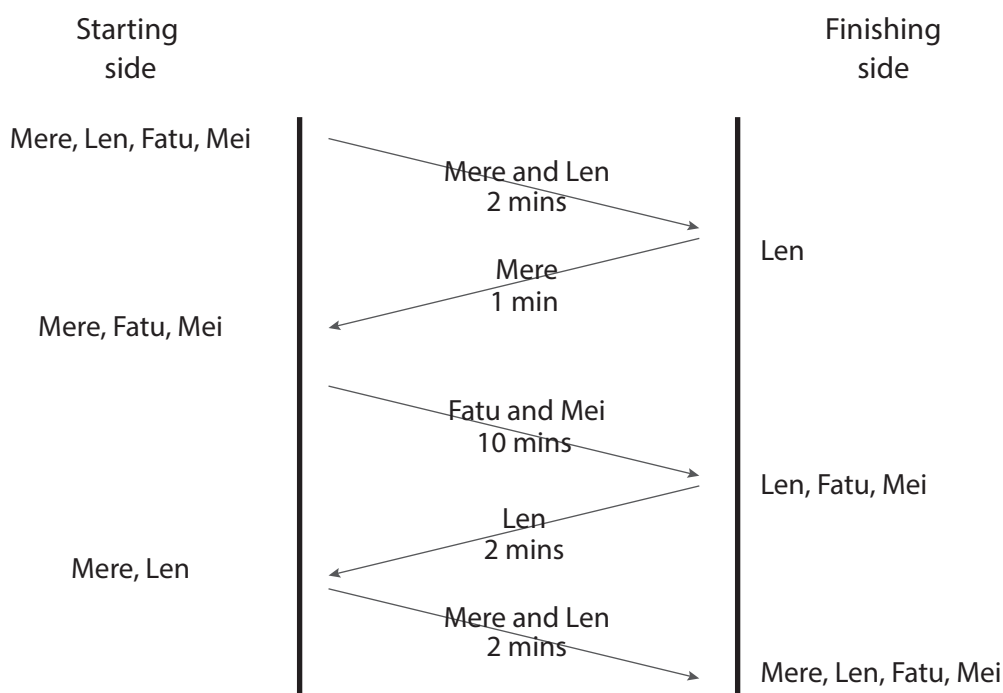
nzmaths.

Learning at home: Notes for whānau

When your child finishes each activity, ask them to add a mouth to the face to show how they felt about that activity.

Problem 1:

Ensure that your child understands the conditions of the problem, particularly that each trip to the far side involves two people, and each trip back involves one person carrying the torch. A pair of people can only travel at the pace of the slowest person. Drawing a diagram of each attempt supports working memory and establishes a record of trials. The fastest time is 17 minutes as shown below:

Starting side — Finishing side

Mere, Len, Fatu, Mei
→ Mere and Len 2 mins → Len

Mere, Fatu, Mei
← Mere 1 min ←

Fatu and Mei 10 mins → Len, Fatu, Mei

Mere, Len
← Len 2 mins ←

→ Mere and Len 2 mins → Mere, Len, Fatu, Mei

Problem 2:

Random attempts to count the number of triangles will not be successful. A system is needed.

Start with the small triangles with a side length of 1. There are 15 of them facing upwards and 10 facing downwards.

Move to the triangles with side lengths of 2. There are 10 of them facing upwards and 3 facing downwards.

Move to the triangles with side lengths of 3. There are 6 of them facing upwards and none facing downwards.

Move to the triangles with side lengths of 4. There are 3 of them facing upwards and none facing downwards.

Finally count the large triangles with side length of 5.

Altogether there are 48 triangles.

Problem 3:

Anusha's age might be found by guess and check. That approach should be based on reasonable speculation about possible ages for Anusha and Prakash, given Mother and son are 25 years apart. Good questions to ask are:

- What is a reasonable first try for their ages?
- How can you test to see the ages you try are correct? (Add 20 to both ages to see if Anusha's age is twice Prakash's age)
- What changes if you add or subtract one from the ages you tried first?

The correct solution is that Anusha is 30 years old and Prakash is 5 years old. Note that the problem can be solved algebraically but that is not usually expected at Year 8.

Composites and primes:

In general, the number of factor pairings, that a given number of squares has, gives the number of possible rectangles.

16 is a composite number with these factor pairs: 1 x 16, 2 x 8, 4 x 4. So three rectangles are possible, including a square. That is why 16 is also regarded as a square number.

17 is a prime number with only one factor pairing: 1 x 17. Therefore only one rectangle can be made with 17 squares.

18 is also composite and has the following factor pairs: 1 x 18, 2 x 9, 3 x 6. So three rectangles are possible.
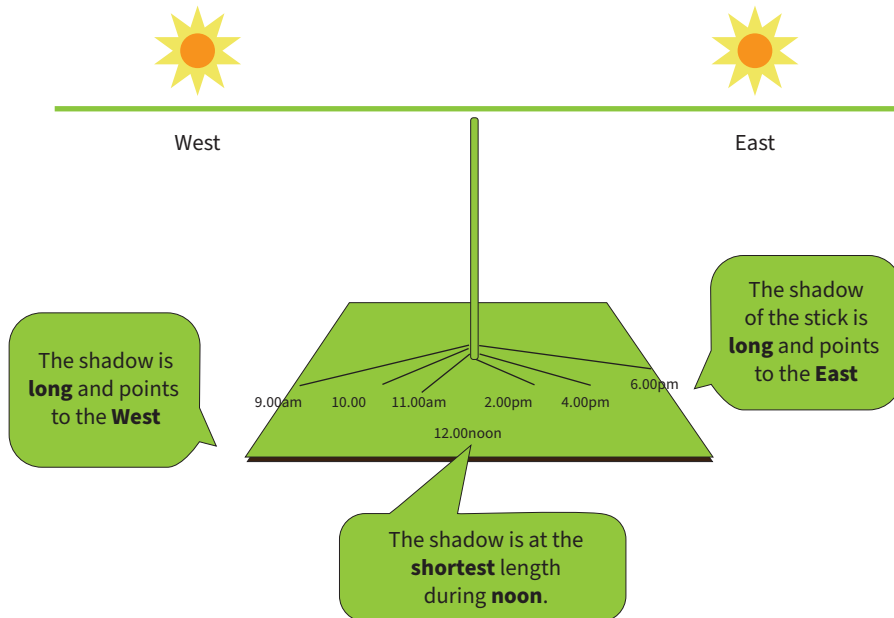
Placing numbers:
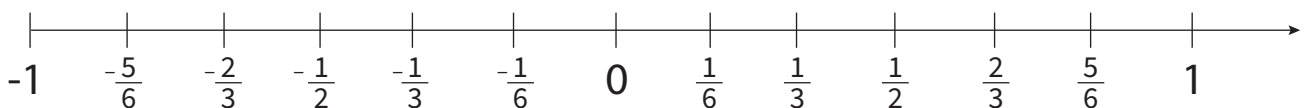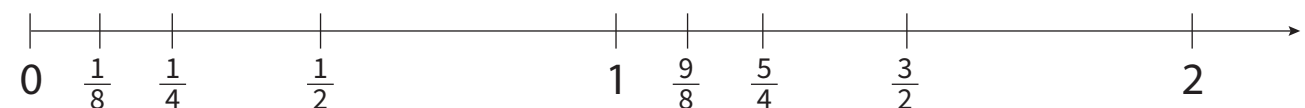
Your child should show understanding of the place of fractions in relation to one, and negative numbers in relation to zero and the positive rational numbers (fractions).

Shadows:

Shadows are caused by a body blocking the path of the sun's rays to a surface. The height of the sun in the sky impacts on the length of a person's shadow. The higher the sun, the shorter the shadow. The lower the sun, the longer the shadow. At midday (unless there is daylight saving) a person's shadow is at it's shortest. Since the sun rises in the East at dawn, the shadow will fall West. The opposite happens at dusk when the shadow falls East.

West   East

The shadow is **long** and points to the **West**

The shadow of the stick is **long** and points to the **East**

9.00am   10.00   11.00am   2.00pm   4.00pm   6.00pm

12.00noon

The shadow is at the **shortest** length during **noon**.

Pattern finding:

Does your child notice what changes and what remains the same as the pattern grows?

They should see that two squares are added to schnitzel's body as he ages one month. All else remains constant.

A table is one way to organise the data.

Constant

Changing by two squares each month
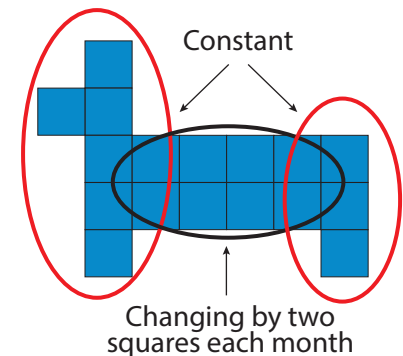
Number of months	1	2	3	4	5	…	
Number of squares	11	13	15	17	19	…	

Extending the table is one way to find the number of months that matches 39 squares.

A rule-based strategy might be:

The number of squares is always two multiplied by the number of months plus nine. ($s = 2m + 9$)

Reversing the rule involves undoing it in the correct order. $39 - 9 = 30$ then $30 \div 2 = 15$ gives the age of Schnitzel in months.