Gearing Up

You need
- the recording tables (see copymaster)
- different-sized plastic cogs
- a pinboard and pins
- a bicycle with gears
- a computer spreadsheet/graphing program (optional)
- a classmate

Activity One

Ian and Taine are playing a game with the box of plastic cogs they have in their classroom.

1. a. With a classmate, play their game:

- Each choose a cog without looking (like a lucky dip).
- Pin the cogs to a pinboard through the centre holes so that the teeth mesh.
- The first player rotates their cog one full turn while the second player counts the number of complete turns their own cog makes.
- The second player gets a point for each complete turn of their cog. If their cog does less than one turn, they get no points.
- Repeat, with the second player doing the turning and the first player scoring points.

   b. Play the game several times.
   What do you notice about the cogs when you win lots of points?

2. Play 5 more games, but this time, record your data on your copy of the table:

Game	Number of teeth on the first cog	Number of teeth on the second cog	Number of turns the second cog makes when the first cog is turned once	Number of turns the first cog makes when the second cog is turned once
1				
2				

3. What patterns can you see between the number of teeth and the number of turns?

4. a. If you add a third cog, what happens to them all as they turn?
   b. Does it matter how many cogs there are in a cog "train"?

Activity Two

"Cogs" on bikes are called sprockets. They don't mesh together directly but are connected by a chain.

Do this activity with a classmate. If you don't own a bike with gears, work with someone who does.

1. Discuss why bikes have gears.
2. a. i. Turn a bike upside down. Tape a flap of paper to a spoke of the rear wheel so that it will hit against the frame.
   ii. Choose a combination of sprockets. Turn the pedals 5 times. Count the number of times the rear wheel turns.
   iii. Systematically repeat for all other combinations of sprockets.
   b. Record in a table or spreadsheet the number of rear wheel turns for each combination of sprockets that you trial. For example:

Turns of Wheel per 5 Turns of Pedals

Front sprocket (teeth)	Rear sprocket (teeth)					
	13	15	17	20	24	28
51	19					
40						

   c. Graph your data. Discuss what your graph tells you.

3. a. Take turns to go for a ride around the playground or another safe area and change the gear settings as you go.

   b. Discuss what you observed during your rides:

      i. Which combination of sprockets requires least force?

      ii. Which combination of sprockets requires most force?

      iii. Why do some combinations of sprockets require more force than others?

4. Use your graph to help you answer these questions:

   a. Which combinations of sprockets are best for going up hills? Why do you think this?

   b. Which combinations of sprockets might you use going down a hill? Why?

   c. Which combinations of sprockets would you use on the flat? Would you start off in one of these combinations? Why or why not?

Focus Observing and interpreting changes in ratio