



Sporty Maths

Education Kit

Acknowledgements

This education kit contains material produced by programs staff at Scienceworks.

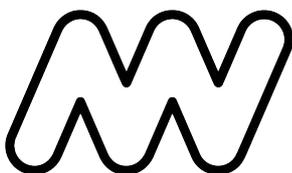
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Scienceworks

2 Booker Street, Spotswood, Victoria 3015

Bookings: Phone (03) 9392 4819 between 8.30am and 4.30pm weekdays



SCIENCEWORKS

Teacher Notes

This education kit provides activities aligned to the Victorian Curriculum.

Sporty Maths is suitable for students in Years 3–7. An excursion to the Sportsworks exhibition at Scienceworks is used to collect data for analysis both during the excursion and on return to school.

The *Sporty Maths* self-guided student program uses the hands-on activities in the *Sportsworks* exhibition at Scienceworks for students to measure and record data relating to aspects of their fitness. The data collected is collated back at school and used to investigate students' understanding in a variety of maths topics, including:

- Measurement
- Estimation
- Decimals
- Fractions
- Collecting and analysing data
- Graphing data

Students work in small groups to analyse parts of the data and share their findings with others. The *Sporty Maths* resource contains a variety of activities teachers can select and use whilst in the exhibition, depending on student and curriculum needs.

Program Outline

Please note that all *Sportsworks* exhibition based programs are led by you, the class teacher. Activities may be completed in any order. If an exhibit is crowded, students should be advised to move on to the next one and return later. Once the set activities have been completed students should be encouraged to explore the other exhibits in Sportsworks.

Note to teachers

There are some students who lack confidence or feel uncomfortable about their physical ability and/or taking part in competitive activities. In activities requiring students to race against a partner, try to match up students who are similar in size, strength and skills.

Explain to students they are gathering data not competing against each other so it is not necessary to be the fastest, strongest or best.

What to do before you visit

Research has shown that setting objectives for a museum visit is extremely important for students. It makes the purpose of the visit clear to them and assists their ability to focus and cooperate during the visit.

Decide which activities students will complete while at Scienceworks. It is recommended that you choose to do either a few activities or the Class Data Project. There may not be enough time to complete all activities and teachers should select the appropriate activities for students complete while at Scienceworks.

Each Student Activity should have some discussion with students prior to the visit. As a class, students will need to make a number of decisions including:

- which tasks they will complete
- how they will go about collecting the information they need during their visit
- what form their final presentation will take

Creating interest in the subject is vital to a successful and enjoyable visit to Scienceworks. In order to assist you in this way, this education kit contains suggestions for activities you may choose to do prior to your visit.

- Discuss how maths is used in everyday life. In what ways do we use maths in sport, other than for keeping scores?
- Hold an introductory discussion with the class on statistics – where we find them, what they are used for, etc. Unpack ideas about the word average (mean) – how we use it in everyday language, and its particular meaning in maths.
- Explain the difference between, mean (average), median and mode for a set of data discussing where each could be used and where the use of one would be better than the use of another.

Victorian Curriculum links

- Mathematics – Measurement and geometry, Statistics and probability and Fractions and Decimals (Year 4 –Year 7)
- Capabilities – Personal and social (Year 4-7)

Teacher Notes

Concept	Definition
Average	See Mean
Estimate	A close guess of the actual value, usually with some thought or calculation involved.
Mean	The mean is a calculated "central" value of a set of numbers. To calculate the mean add up all the numbers and divide by how many numbers there are. The mean is also called the average.
Median	The middle number (in a sorted list of numbers). Half the numbers in the list are less, and half the numbers are greater. To find the Median, place the numbers you are given in value order and find the middle number. The median lies on an actual number if there is an odd number of data pieces and in between the two middle numbers for an even number of data pieces.
Modal Group	Divide data into 6-12 groups, by starting at the low end of the data and going up in intervals of 5 or 10 (or greater, depending on the range) and circling the data in each interval with a marker. Eg. all Heights from 140-144, 145-149, 150-154, etc. The modal group is the interval with the most pieces of data in it.
Mode	The number that has the highest 'frequency' (i.e. appears the most times) is the mode. (Sometimes there will be no mode for a set of data or there may be more than one mode for a set of data).
Predict	Declare or indicate probable result in advance.
Prediction	Guess of the value of result yet to be obtained.
Range	The difference between the highest and lowest number.

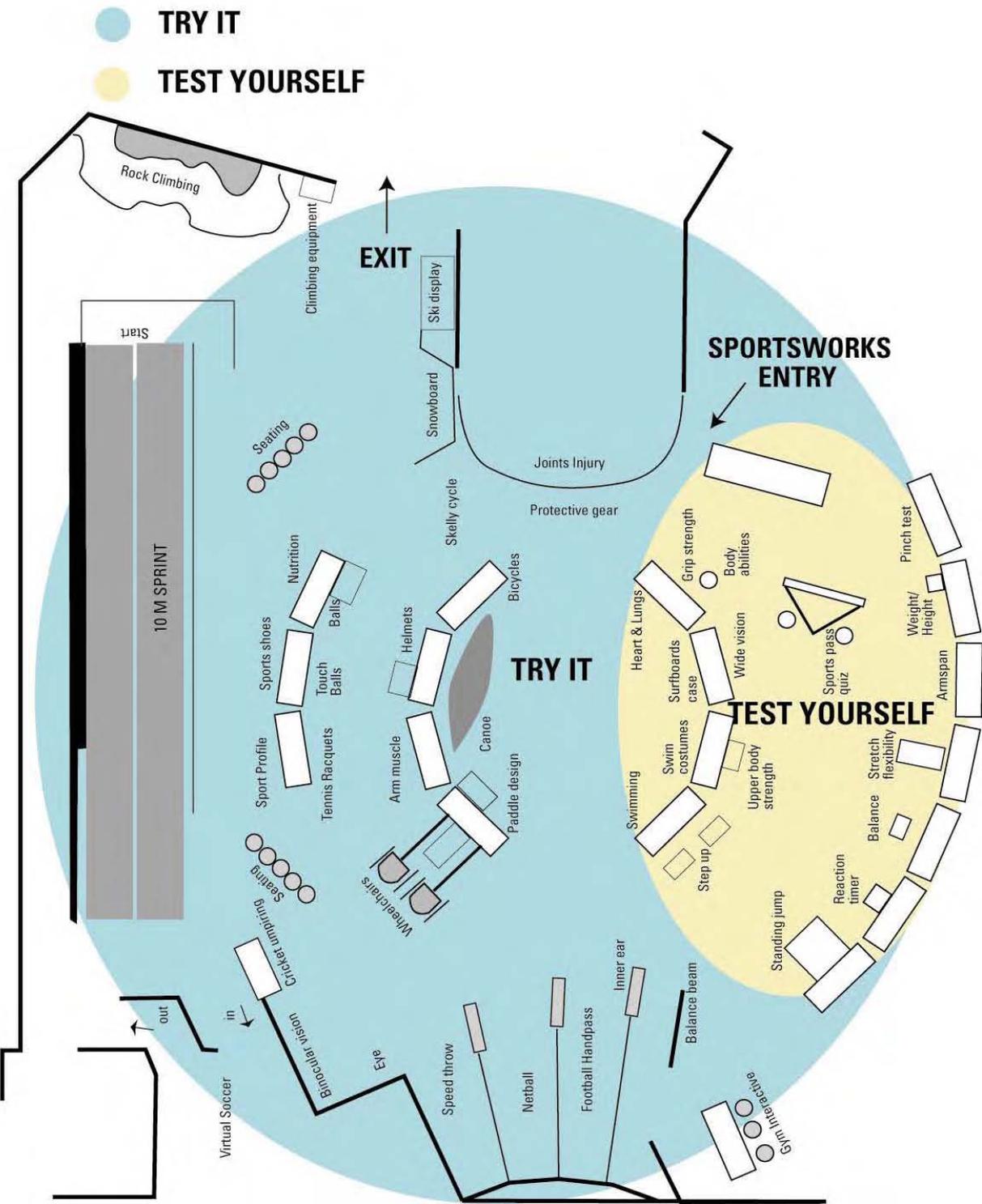
Mathematics organisations

The Mathematical Association of Victoria
61 Blyth St
Brunswick, VIC 3056
Tel: 03 9380 2399
Website: mav.vic.edu.au/Home

Australian Mathematics Trust
University of Canberra
ACT 2601
Tel: 02 6201 5136
Fax: 02 6201 5052
Website: amt.edu.au

Australian Association of Mathematics Teachers Incorporated
C/AMT
170 Haydon Drive
Bruce, ACT 2617
Tel: (02) 62015265
Website: aamt.edu.au

Sportsworks Exhibition Floor Plan



ACTIVITY 1: Racing Cathy

Name: _____

Collecting the data

What to Do: Go to the **Sprint Track**

- Line up on the start line with your partner.
- When you hear the starting gun race to the finish line.
- Make sure you stay in your lane!
- Look up above the finish line to see your time.

Write **your** time here:

Write **your partner's** time here:

Write **Cathy's** time here:



Source: Rob Blackburn, Paoli Smith

Looking at the data:

1. Write the three times in order from *slowest* to *fastest*. Under the times write your name, your partner's name, and 'Cathy'.

Times: _____

Names: _____

2a. What is the **difference** between your time and your partner's time?

Difference = _____

b. If you, your partner and Cathy ran in a relay, what would be your **combined** time?

Combined time = _____

The times at the finish line are displayed as decimal numbers.

3a. Write the decimal times as fractions or mixed numbers

Your time

Partner

Cathy

b. How many different ways can you write the three fractions?
Put your answers in the box below.

Your Time	Partner	Cathy

ACTIVITY 2: You Be The Judge!

Name: _____

Collecting the data**What to Do**

- Ask another pair of students to join you and your partner.
- Go to the **gymnastics** exhibit.
- Three of you will be judges while the fourth person will listen out for the coach's score.
- The scores for each judge are displayed above the screen. Press 'Clear' on the keypad until they show '0'. Now you are ready!



Source: Tim Byrne

Watch the routine and listen to the judge's commentary.

At the end of the routine, use the keypad to enter the score you would give the gymnast.

Your score will come up on the display above the screen.

The coach's score will appear on the screen.

Write down the four scores in the boxes below.

Judge 1

Judge 2

Judge 3

Coach

Looking at the data

1. Write the four scores in order from lowest score to highest score.

_____ , _____ , _____ , _____

2. What is the combined score of the 3 judges and the coach?

Combined Score: _____

3. Calculate the difference between the lowest and the highest scores.

Difference: _____

4. Write each of the scores as a fraction or mixed number in simplest form.

Judge 1

Judge 2

Judge 3

Coach

5. For the gymnasts on the screen, a score of 10 is a 'perfect' score.

Looking at the coaches score, how far off a 'perfect score' was the gymnast you saw?

Give your answer as:

(i) a decimal

(ii) a fraction

ACTIVITY 3: Wheelchair Races

Name: _____

Collecting the data**What to Do**

- Go to the **Wheelchair Race**.
- Ask another pair of students to join with you and your partner.
- Two of you will have a wheelchair race.
- The other two record their partner's finishing time in the box below. (The time is shown on the top left hand corner of the screen.)
- Swap places and record your partner's time for them on their sheet.

*Source: Rob Blackburn, Paoli Smith***My race time:**

_____ : _____ . _____

Looking at the data

1. Draw an arrow pointing to the number of minutes in the time. Write 'minutes' next to the arrow.
2. Draw an arrow pointing to the number of seconds in the time. Write 'seconds' next to the arrow.
3. Circle the part of the time that is less than one second.
4. Write the part you have circled as a fraction of a second.

ACTIVITY 4: Reaction Times

Name: _____

Collecting the data (*collect more data below*)

What to Do

- Go to the **Body Talent - Quick Reactions** exhibit in the 'Test Yourself' section.
- Follow the directions and measure your reaction time three times.

Ask your partner to write each of your times in the boxes below.

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Source: Tim Byrne

Looking at the data

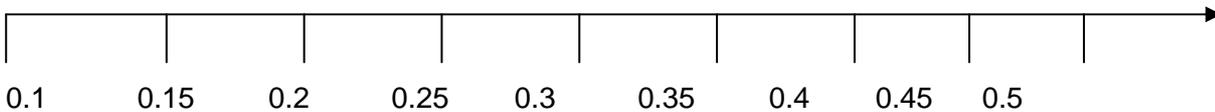
1a. Write your three times in order from slowest to fastest.
(Remember – 'slowest' does not mean 'smallest'!)

_____ , _____ , _____

b. Round off each of your times to the nearest hundredth.

_____ , _____ , _____

c. Show your 'rounded off' times on the number line below.



d. Write each of your times in question 1b as fractions. Simplify the fractions if possible.

Collecting more data

Measure your reaction time two more times. Ask your partner to write each time in the space below.

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Looking at more data

2a. Write out the five reaction times in a line from smallest (fastest) to largest (slowest)

_____ , _____ , _____ , _____ , _____

b. Put a circle around the median number in the line above.

c. Find the range of your reaction time data.

To see how important reaction times are in sport, go and try the **Virtual Soccer Goalie exhibit when you have finished your activities!

ACTIVITY 5: Sharp Shooter

Name: _____

Before the activity**What to Do**

- Go to the **Netball** ring.
- You and your partner will each have at least 5 shots at goal.
- Before you take your shots, predict how many you will get in by filling in the sentence below.



Source: Tim Byrne

1a. I predict I will get _____ out of 5 shots in the ring.

b. Write your prediction as:

(i) a fraction

(iii) a percentage

(ii) a decimal

(iv) a ratio of goals to total number of shots

Collecting the data

- To shoot for goal, stand in front of the ring with your toes just touching the wood.
- Have 5 shots.
- As you shoot, ask your partner to record your shots in the table below, by placing a tick or cross in the right column.
- If you don't get any in after 5 shots, keep shooting until you do get one.
- Swap with your partner and record their shots.

Shot Number	Ball went in ring	Ball hit ring	Ball missed ring completely
1			
2			
3			
4			
5			

Looking at the data

2. Now:

- Write your number of goals as a fraction of the number of shots you had.
- Write this fraction as a decimal, as a percentage and as a ratio (number of goals to the total number of shots), if you can.

Number of Goals	Number of Shots	Result as a Fraction	Result as a Decimal	Result as a Percentage	Result as a Ratio

3. Comment on how accurate your prediction was. Use your fraction, decimal percentage or ratio numbers to help you compare them.

4. Compare your results to your partners.

Looking at these results, who is the more accurate goal shooter? Give a reason for your answer.

_____ is the more accurate shooter, because _____

5. If you had one shot at goal what is the probability:

- a. the ball will go in the ring?
- b. the ball will hit the ring?
- c. the ball will completely miss the ring?

6. If you had 20 shots at goal, how many goals do you think you would get?

Give a reason for your answer.

7. Many sports such as netball, football and tennis, use percentages to describe a player's performance. Why do you think percentages are used, instead of fractions, decimals or ratios?

ACTIVITY 6: Measuring Up!

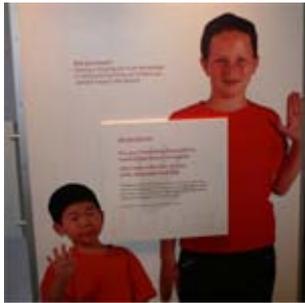
Name: _____

Collecting the data

What to Do

Go to these exhibits in the 'Test Yourself' section: **1. Compare your proportions,**
3. Measure your height and
4. Measure your arm span

These pictures will help you find them.



Source (all images): Tim Byrne

- At each exhibit, you will measure a part of your body using the instructions at the exhibit.
- Before you start measuring, write down an estimate (a guess), in centimetres (cm), in the first column of table below.
- Write down **your** measurements next to the estimates in the table.
- At Exhibit 1 measure your Hand Span (from the thumb to the little finger when your hand is stretched out) in centimetres
- At Exhibit 3 measure your Height in centimetres
- At Exhibit 4 measure your Arm Span (stretch out your arms and measure from finger tip to finger tip) in centimetres
- Record your partner's measurements in the table as well.

Body Part	My Estimate (cm)	My Measurement (cm)	My Partner's Measurement (cm)	My Measurement (m)	My Partner's Measurement (m)
Hand Span					
Height					
Arm Span					

Looking at the data

1a. For which body part was your estimate closest to your measurement? _____

b. Use numbers to describe how close it was _____

2a. For which body part was your measurement closest to your partner's measurement?

b. Use numbers to describe how close it was. _____

3. Many people think that a person's arm span is the same as their height.

How close is your arm span to your height? _____

4. Convert your measurements from centimetres (cm) to metres (m) and write them in the correct column of the table (previous page).

5a. Estimate: About how many 'hand spans' tall are you? _____

b. Could you work this out exactly?

c. Describe what you would do.

6. A cricket pitch is about 20m long. Look at your height and estimate how many of 'you', laid end to end, could fit along a cricket pitch. Describe how you could work this out exactly.

ACTIVITY 7: Race Paces

Name: _____

Collecting the data**What to Do**Go to the **Sprint Track**

- Line up on the start line with your partner.
- When you hear the starting gun, race to the finish line.
- Make sure you stay in your lane!
- Look up above the finish line to see your time.

Write your time here:



1a. What units are used for measuring the race times?

Source: Rob Blackburn, Paoli Smith

b. Have a look

Look at the racetrack you have just run down. Estimate, only by looking, how many metres it is from start to finish.

Write your 'looking' estimate here:

c. Pace it out

Now walk alongside the track and 'pace out' the length from start to finish. Use your paces to improve your estimate.

Write your 'pacing' estimate here:

d. What is it really?

Ask your teacher or a Scienceworks staff member how long the racetrack actually is, and write it down.

Actual length of the racetrack:

Looking at the data**2. How close was I?**

Compare your estimates to the actual length of the track. How close was your best estimate to the actual length of the track? Use numbers to help you describe your answer.

ACTIVITY 8: Jump For It!

Name: _____

Collecting the data

Go to **Body Talent - Explosive Power**.
It's Exhibit 8 in the 'Test Yourself' section.

Follow the instructions and jump as high as you can.
Record the height of three jumps for you and three for your partner in the table below.



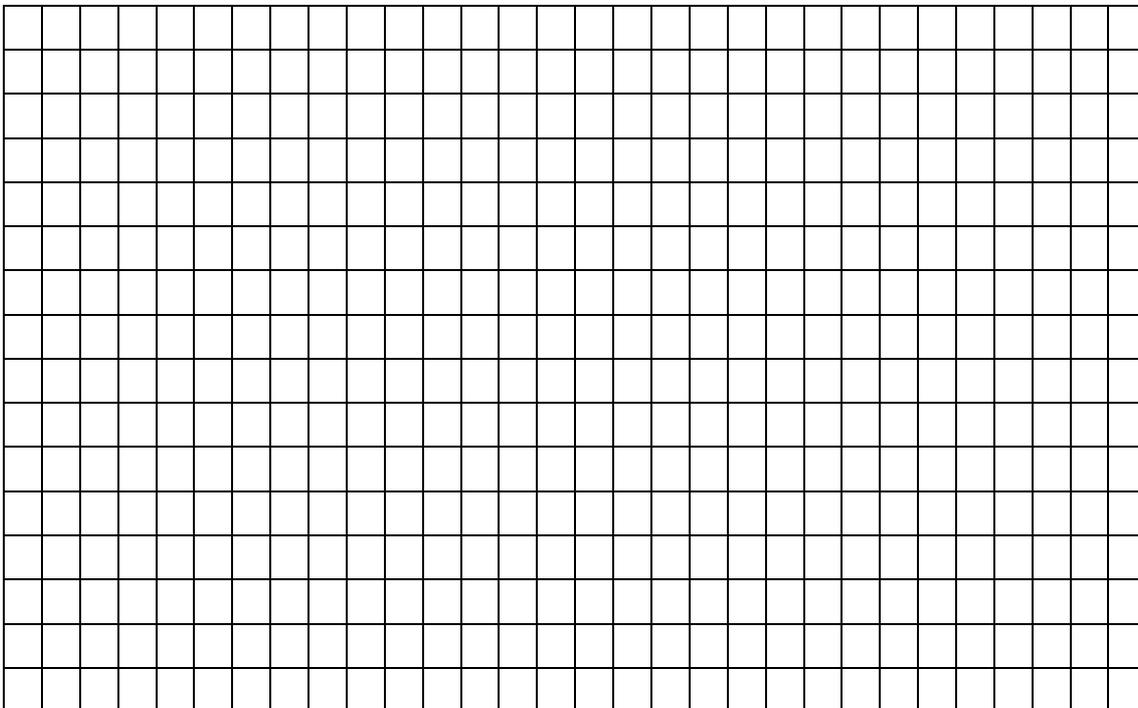
Source: Rob Blackburn, Paoli Smith

Jump	Me	My Partner
1		
2		
3		

1. What units are the jumps measured in? _____

Looking at the data:

2a. Show your and your partners results as a bar graph on the grid below.
(Provide labelled axes and scale)



(b) Name two sports where it would be useful to have 'Explosive Power'.

ACTIVITY 9: AFL Star

Name: _____

Collecting the data

What to do

Go to the **Football Handpass** exhibit with Adam Cooney.

- You will have 5 goes at handpassing the football through the hole.
- Agree with your partner where you will stand to do the handpassing – it should be at least two big steps away from the hole.
- Before you start, predict how many handpasses you will get in the hole by filling in the sentence below.



Source: Rob Blackburn, Paoli Smith

1a. I predict I will get _____ out of 5 shots in.

b. As you shoot, ask your partner to record your shots in the table below, by placing a tick in the right column to show what happened.

c. Swap with your partner and record their shots.

Shot Number	Went in	Ball hit side of the hole but didn't go in	Ball missed hole completely
1			
2			
3			
4			
5			

Looking at the data:

2a. Comment on how accurate your prediction was _____

b. If you had 20 handballs, do you think you would get more in?

c. How many would you get?
 Explain your answer.

ACTIVITY 10: Angles Of Vision

Name: _____

Collecting the data

Go to **Body Talent - Wide Vision**. It's Exhibit 12 in the 'Test Yourself' section.

1a. Follow the instructions to measure your 'Angle of Vision' for your left eye.

Angle = _____°

(b) Now measure the Angle of Vision for your right eye.

Angle = _____°



Source: Tim Byrne

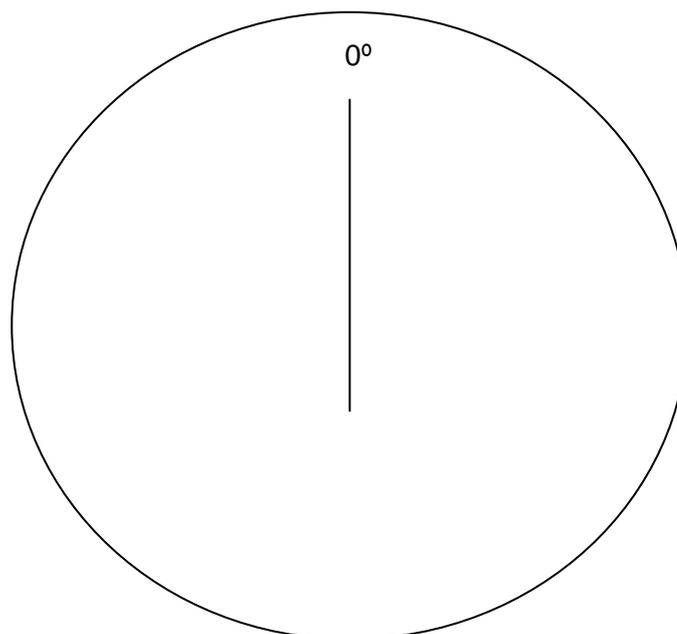
Looking at the data

2a. Draw your eyes at the centre of the circle, looking straight ahead at the 0° mark.

- Show the angle of vision for each eye by drawing a straight line from the eye to the edge of the circle.
- Label each angle with its number of degrees

b. Colour in the space inside your angles to show your complete 'field of vision'.

3. What is your Total 'field of vision'? _____



Class Data Project

Students use the *Sportsworks* exhibition at Scienceworks to measure and record data about their own abilities. Data collected by the class is collated back at school where students work in small groups to analyse the data and share their findings.

At Scienceworks

Students use a 'Sportspass' to record their personal data in the 'Test Yourself' section of the *Sportsworks* exhibition. There may not be enough time to complete all 13 stations and still see the rest of the exhibition, so go through the Sportspass with students beforehand and decide which stations the students will collect data from and how many pieces of data they will record at each station.

Groups of students will need to be broken up and started at different stations.

Back at School

Collecting the data

1. Give every student several sticky-backed notes. On the board, write large headings for each category of data the students collected on the Sportspass ('Hand Width', 'Height' etc). Ask students to write each category on an individual note, and their particular measurement for that category. (If students recorded more than one measurement, they could choose their best one, or give the mean, if they are able to easily calculate it).
2. Students come up to the board and place their sticky notes under each category. Check that you have the class number of 'stickies' under each heading.

Analysing the data

3. Choose one set of data to work through and model the calculations with the whole class. With students help, line up stickies in one line across the board from smallest number to largest. Organising the data this way makes it easier to do the following calculations:

Median – find the middle number (counting in from both ends is a nice visual way). Point out that the median lies on an actual number if there is an odd number of data pieces and in between the two middle numbers for an even number of data pieces.

Mean – add up the numbers on the line of stickies, and divide by how many stickies there are. Note that it is daunting to do one long sum without errors (by hand or calculator); it is easier to add up a few numbers at a time, and then sum these totals.

Mode – look through the line for any numbers that are the same and circle them or stack them up. The number that has the highest 'frequency' (i.e. appears the most times) is the mode. (Sometimes there will be no mode for a set of data or there may be more than one mode for a set of data).

Range – find the difference between the highest and lowest number.

Modal Group - divide data into 6-12 groups, by starting at the low end of the data and going up in intervals of 5 or 10 (or greater, depending on the range) and circling the data in each interval with a marker. Eg. all Heights from 140-144, 145-149, 150-154, etc.

The modal group is the interval with the most pieces of data in it.

A frequency table can now easily be drawn up.

Graphing Data

- Stacking the stickies in each interval one above the other creates an instant **frequency histogram**.
- Forming a circle out of the line of stickies, then drawing lines from the centre out to form each sectors for each interval creates an instant **pie graph**.

These can be done kinaesthetically with the students themselves each taking their own piece of data and lining up in order from largest to smallest value.

To form a **frequency histogram**, students line up in groups behind large cards marked with each interval of the data and placed in a line on the ground.

To make a **pie graph**, take the original, ordered line of students and bend them around in a circle. Use string radiating out from the centre of the circle to form the pie graph sectors – get students at the ends of each interval to hold them.

Discussing the angle made by each sector and the number of students in each sector leads to how to calculate angles for drawing the pie graph

$$\text{(no. of students in the interval) / (no. of students in class) x } 360^\circ$$

(Level 5: *Dot Plots* and *Stem and Leaf Plots* can also be modelled using the sticky notes. A double *Stem and Leaf Plot* can be used to compare two groups of students in the class eg. boys and girls)

Once all the required calculations have been modelled, break the class up into work groups of 3 or 4 students. Assign each group at least one category of data to work on, and give them all the sticky notes from that particular category. (Some groups may be able to handle more than one group of data).

Students work together to calculate each of the statistics required and create frequency tables and graphs.

When data has been collated groups (or the class) should discuss the difference between the values obtained for mean, median and mode and the significance of each. Which gives the best estimate of the value? What does the range tell you?

ICT

Excel can be used to display the collected data in tables and graphs. Functions such as 'Sum' and 'Sort' may be used to further analyse the collected data. If students have some experience, they may be able to construct Excel formulae for Mean, Median and Mode.

A central file or a Wiki may be used for groups to share their calculations with the rest of the class.

Including pictures of the sports where each attribute would be useful (or pictures taken by the students at Scienceworks) produces a colourful visual presentation for the class.

Science

Choose one of the categories of data (e.g. Reaction Time, Jump Height, Upper Body Strength, Hand-Eye Coordination, Grip Strength).

Research the types of sports in which this attribute could be an advantage and why.

Interpersonal Learning

Students work collaboratively when handling data and producing their presentation product.

Presentation of Data

There are many ways data can be presented. A visual interpretation of the data collected can be shown by:

1. Tracing around the body of a group member to produce a life size poster.
 - Label five or six of the types of data and the part of the body they pertain to.
 - Place Mean or Average values next to the labels.
 - The poster could be labelled 'The Average Student in Class 6C'.
 - Inside the poster could contain selected graphs, tables and calculations.
2. Data may also be presented using a slide show or PowerPoint presentation that could include photographs taken while at Scienceworks as well as data collected.
3. A presentation may be created using Excel including charts and graphs comparing individual and class data.

These are a few options for how you can present your data, can you think of another way?