TEACHING IDEAS FOR 'MATHEMATICS AND SPORT'

Introduction

Separate from this guide, there are three files that you will find useful.

- Before the visit: 'How is maths used in sports' - an introduction to the spots and the maths, and the concept of a project linking the two.
- At the NSM: 'Mathematics at the National Sports Museum' - questions and answers to match while at the museum.
- After the visit: 'Pick your sports' - an electronic resource for use as a project back at the school or for homework. To help you guide your students to mathematics suitable for their level, the later pages in this document show the Australian Curriculum (AusVELS) level for different sections of this paterial.

At the NSM: Mathematics at the National Sports Museum

There are 14 questions linked to separate areas of the NSM. The information is readily available in or around the displays, but students will have to search for it. You could encourage students to work in teams and share the task of finding the answers.

The answers may be found in any order. The answers are also provided, but in random order. Students must find the answer in the museum and also on the sheet. Each answer is linked to a capital letter. The letters go into the spaces below the answers, and will spell out a short sentence when completed. You might prefer to keep the answer sheet for use back at the school.

Back at school: 'Pick your sports' electronic resources

Ten sports are covered in the electronic resources. They are organised by sport, and within each there are two kinds of activity.

- Several (often many) good links to motivating and educational sites on the internet that somehow relate to mathematics and each sport. You might like to explore some of these and select some to recommend to your students. You might also like to prepare suitable worksheets to guide students in how you wish them to respond. Without understanding the sport, much of the maths is hard to follow.
- There are many links to prepared worksheets or even complete investigations based around sport. For example, there is one (prepared by Cricket Australia) called 'Cricket Smart'. In general these materials are not designed to teach the mathematics. Instead they use an exciting context (sport) to get students interested in learning mathematics. Sometimes, that is 90% of the battle. You do the rest. Adapt and create worksheets to meet the learning needs and real levels of your students. They will respond well.

There are many ways of using these materials back at your school.

- You might let students explore the whole package and write an essay about how mathematics is used in sport. The essay should contain some examples they have found.
- You might ask students to choose a sport and explore it in depth. It is well known that students who are really interested in a context of real life mathematics (such as a favourite sport) can far exceed the 'level' at which they might normally perform. In this case we are using a 'theme' to motivate learning. It works! However you will know that the students are at different points along their learning journey in mathematics, so they should not be asked to work other than in groups who are at a similar level.

  To help you know what curriculum content might be addressed by students tackling each section, a list of content is provided under the headings of each section.

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- You might also try to select bits of one or more sports and use them to supplement your regular curriculum. It is possible that this will have less success, unless all students are interested in the same sport.
  To help you select for this purpose a list of the curriculum content statements have been prepared - and the sections of the electronic material connected to each are listed.

SPORT TOPICS		Maths content and year level for each
Cricket		
1	Hall of fame	Number 6-9
2	Women's cricket	Describe and interpret different data sets in context 6 Interpret secondary data 6 Calculate mean, median, mode and range 7
Bradman		
3	Scores and averages	Calculate mean, median, mode and range 7 Describe and interpret data displays and the relationship between the median and mean Interpret secondary data 6
4	Comparison with other sports	Calculate and interpret the mean and standard deviation of data and use these to compare data sets about a population based on a sample 10A
Warne		
5	Impossible ball	Estimate angles 5
6	Statistics	Interpret secondary data 6 Describe and interpret data displays and the relationship between the median and mean 7
Batting		
7	Run rate	Solve a range of problems involving rates and ratios 8
8	Compute batting averages	Calculate mean, median, mode and range 7
Bowling		
9	Fast - speed	Solve problems involving direct proportion 9
10	Swinging the ball	Magnus effect Year 11 and 12 Science
11	Bouncers	Estimate, measure and compare angles using degrees 5 Construct angles using a protractor 5 Solve problems involving direct proportion 9
12	Bowling averages Paradox (averages)	Calculate mean, median, mode and range 7 Solve a range of problems involving rates and ratios 8 Solve problems involving direct proportion 9 Explore the relationship between graphs and equations corresponding to simple rate problems 9 Plot linear relationships 8

13	Spin bowling	Estimate angles 5

Fielding

14	grounds	Solve problems involving the comparison of lengths and areas 6
15	Wagon wheels	Describe and interpret data displays 7
16	Fielding reaction times	Solve a range of problems involving rates and ratios 8
17	Throws and catches in the out-field	Graph simple non-linear relations 9 Explore the connection between algebraic and graphical representations of relations such as simple quadratics 10
18	Two tied matches	Describe and interpret data displays 7

Simulations

19	Dice cricket game	Conduct chance experiments 6 Compare observed frequencies across experiments with expected frequencies 6 Calculate relative frequencies from collected data to estimate probabilities 9
20	Limited over	Explore the relationship between graphs and equations corresponding to simple rate problems 9

AUSTRALIAN FOOTBALL

The game

21	Scoring	problems involving all four operations with whole numbers 6 Plot linear relationships 8
22	Dice simulation	Conduct chance experiments with both small and large numbers of trials using appropriate digital technologies 6 Compare observed frequencies across experiments with expected frequencies 6
23	Probability of a draw	Describe probabilities using fractions, decimals and percentages 6
24	Ladder calculations	Problems involving all four operations with whole numbers 6 Find percentages of quantities 7
25	Grounds (shapes, sizes)	Solve problems involving the comparison of lengths and areas 6

The league and clubs

26	Ladder position over time	Describe and interpret different data sets in context 5
27	Premierships	Compare observed frequencies across experiments with expected frequencies 6 Calculate mean, median, mode and range for sets of data. Interpret these statistics in the context of data 7

The home and away series

28	Round robin matches	Explore the connection between algebraic and graphical representations of relations such as simple quadratics 10

29	Probability of a draw	Conduct chance experiments with both small and large numbers of trials using appropriate digital technologies 6

The Finals series

30	Final 4 vs Final 8	Conduct chance experiments with both small and large numbers of trials using appropriate digital technologies 6 Compare observed frequencies across experiments with expected frequencies 6

Famous players — Interpret secondary data presented in digital media 6

31	Compare statistics	Identify everyday questions involving numerical & categorical variables 9

Using data and statistics

32	Height vs mass	Plot linear relationships 8 Use scatter plots to investigate and comment on relationships between two continuous variables 10
33	Predicting the final ladder	Use scatter plots to investigate and comment on relationships between two continuous variables 10
34	What relates to a win?	Calculate mean, median, mode and range for sets of data. Interpret these statistics in the context of data 7

ATHLETICS

Track events

35	Speed (in m/s <> km/h)	Solve problems involving direct proportion 9
36	Speed vs distance	Use scatter plots to investigate and comment on relationships between two continuous variables 10
37	Staggered starts	Investigate the relationship between features of circles such as circumference 8

Field events

38	High jump-three styles	Calculate mean, median, mode and range for sets of data. Interpret these statistics in the context of data 7
39	Record height vs time	Use scatter plots to investigate and comment on relationships between two continuous variables 10
40	Long jump - Beamon	Describe and interpret different data sets in context 5
41	Record length vs time	Use scatter plots to investigate and comment on relationships between two continuous variables 10
42	Triple jump (ht vs time)	Use scatter plots to investigate and comment on relationships between two continuous variables 10

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BASKETBALL

National teams

43 Boomers/Opals stats the context of data 7 Playing	Calculate mean, median, mode and range for sets of data. Interpret these statistics in
44 Slam dunk	Solve problems involving the comparison of lengths 6
45 Penalty goal shoot	Conduct chance experiments with both small and large numbers of trials 6 Explore the connection between algebraic and graphical representations of relations such as simple quadratics 10
46 Movement on court	Conduct chance experiments with both small and large numbers of trials 6

CYCLING

7 Tour de France	Interpret and use timetables 6 Use a grid reference system to describe locations. Describe routes 5

Other road racing

48 Speed and distance	Use a grid reference system to describe locations. Describe routes 5 Solve problems involving direct proportion 9
49 Velodrome geometry	Estimate, measure and compare angles using degrees. 5

Bicycle geometry

50 Frame (shape)	Estimate, measure and compare angles using degrees 5 Apply the enlargement transformation (scale drawing) 5
51 Gears, cadence, speed	Solve problems involving direct proportion 9

HORSE RACING

Melbourne Cup

52 Distance, time, speed	Solve problems involving direct proportion 9

Horses

53 Pharlap,	Interpret secondary data 6
54 Carbine	Interpret secondary data 6
55 Jockeys - Beasley	Interpret secondary data 6
56 Trainers - Cummings	Interpret secondary data 6
57 Handicapping system	Interpret secondary data 6

Gambling

58	Sweeps, TAB, Bookmakers	Conduct chance experiments with small and large numbers of trials 6
59	Prob of favourite winning	Calculate relative frequencies from collected data to estimate probabilities 9

SWIMMING

Famous swimmers

60	Distances, times, speeds	Solve problems involving direct proportion 9
61	Wins, records, gold medals	Construct displays appropriate for data type 5 Describe and interpret different data sets in context 5 Interpret secondary data 6

GOLF

62	Famous golfers	Construct displays appropriate for data type 5 Describe and interpret different data sets in context 5 Interpret secondary data 6
63	Geometry Ball dimples	??
64	Choice of club	Use scatter plots to investigate and comment on relationships between two continuous variables 10
65	Putting	Describe probabilities using fractions, decimals and percentages 6
66	Magnus effect	Science
67	Hooks and slices	Construct angles using a protractor 5

SOCCER

68	Socceroos, Matildas	Construct displays appropriate for data type 5 Describe and interpret different data sets in context 5 Interpret secondary data 6
69	World Cup	Calculate relative frequencies from collected data to estimate probabilities 9
70	Goalie	Estimate, measure and compare angles using degrees 5
71	Dice soccer simulation	Conduct chance experiments with both small and large numbers of trials using appropriate digital technologies 6 Compare observed frequencies across experiments with expected frequencies 6
72	Angle kicking at goal	Estimate, measure and compare angles using degrees 5
73	Ball	Connect three-dimensional objects with their nets 5

TENNIS

74	Famous Australians	Construct displays appropriate for data type 5 Describe and interpret different data sets in context 5 Interpret secondary data 6
75	Scoring - games	Problems with whole numbers 6
76	Sets & matches	Conduct chance experiments 6
77	Serving - speed	Solve problems involving direct proportion 9
78	Swing and kick	Science
79	Angles	Estimate, measure and compare angles using degrees 5
80	Drive, smash, volley	Estimate, measure and compare angles using degrees 5

MATHS CONTENT DESCRIPTIONS BY LEVEL WITH SPORTS TOPICS FOR EACH

Number and Algebra

6 Select and apply efficient mental and written strategies and appropriate digital technologies to solve problems involving all four operations with whole numbers
1, 21, 24, 75

7 Find percentages of quantities and express one quantity as a percentage of another, with and without digital technologies.
24

8 Solve a range of problems involving rates and ratios, with and without digital technologies
7, 12, 13, 16

8 Plot linear relationships
12, 13, 21, 32

9 Solve problems involving direct proportion
9, 11, 12, 143, 35, 48, 51, 52, 60, 77

9 Graph simple non-linear relations 17

10 Explore the connection between algebraic and graphical representations of relations such as simple quadratics
17, 28, 45

Space and Measurement

5 Estimate, measure and compare angles using degrees
5, 11, 13, 49, 50, 70, 72, 79, 80

5 Construct angles using a protractor
11, 67

5 Use a grid reference system to describe locations. Describe routes using landmarks and directional language
48

5 Apply the enlargement transformation (scale drawing)
50

5 Connect three-dimensional objects with their nets and other two-dimensional representations
73

6 Solve problems involving the comparison of lengths and areas using appropriate units
14, 25, 44

6 Interpret and use timetables
7

8 Investigate the relationship between features of circles such as circumference
37

Probability and Statistics

5 Construct displays, including column graphs, dot plots and tables, appropriate for data type, with and without the use of digital technologies
61, 68,74

5 Describe and interpret different data sets in context
2, 26, 40, 61, 68, 74

6 Describe probabilities using fractions, decimals and percentages
23, 66

6 Conduct chance experiments with both small and large numbers of trials using appropriate digital technologies
19, 22,. 29, 30, 45, 46, 58, 71, 76

6 Compare observed frequencies across experiments with expected frequencies

6 Interpret secondary data presented in digital media and elsewhere
3, 6, 53, 54, 55, 56, 57, 61,68, 74

7 Calculate mean, median, mode and range for sets of data. Interpret these statistics in the context of data
2, 3, 8, 12, 27, 34, 38, 43

7 Describe and interpret data displays and the relationship between the median and mean
6, 8, 15, 18

9 Identify everyday questions and issues involving at least one numerical and at least one categorical variable, and collect data directly from secondary sources
31

9 Calculate relative frequencies from collected data to estimate probabilities
19, 59, 69

10 Use scatter plots to investigate and comment on relationships between two continuous variables
32, 33, 36, 349, 41,42, 64

10A Calculate and interpret the mean and standard deviation of data and use these to compare data sets about a population based on a sample4

11 Science: Magnus effect 10, 66, 78.