

Year 8

Read the marking rubric attached to obtain full Marks for this task.

Directed Numbers – Number and Algebra

Many board games engage the players in racing each other to the end of the board. Snakes and Ladders is an example of this style of game. You can climb ladders to get to the end quicker but sliding down a snake means you get further away from the end.

Such board game helps you to practice addition and subtraction of directed numbers. This game is played with 2 dice and is a race to the end of the number line provided on the board, start from 0 and end at 100. (You can have a look/search of few Snakes and Ladders board game on internet).

Question 1

[5 marks]

Two dice (*6 sided each die*) are to be used in this board game. Die 1 is labelled with 3 N's and 3 P's, and die 2 is labelled with the integers -1, -2, -3 and +1, +2 and +3. Rolling an N means you face the negative numbers; rolling a P means you face the positive numbers.

- Imagine that you are at 0, and that you roll an N and +2. N means that you face the negative numbers; +2 means that you move forward 2 places.
 - If you roll a P and +1, this means that you face the positive numbers and move forward 1 place.
 - If you roll a P and -2, this means that you face the positive numbers and move backwards 2 places.
- i) For the 3 examples listed above, state which square you would end up in if you started at 0 each time.
- ii) Suppose that your first five turns at this game produced the following results on the dice. P and +1, P and +3, P and -2, N and -1, N and +2. If you started at 0, where were you after these five turns?

Question 2

[5 marks]

A Growing Nation – Number and Algebra

Details about a population are collected in a census. Australia's last census took place in August 2016, on a day known as 'census day'. The information provide by the population is collected and analyzed by the Australian Bureau of Statistics over a period of 2 years. After this, the information is released to the public.

The following table displays some characteristics of Australia based on the information collected in the 2011 census.

| Characteristics | Total persons |
|-------------------------------|----------------------|
| Males in Australia | 10634 013 |
| Females in Australia | 10873 704 |
| People aged 15 years and over | 17 363 694 |
| People aged 65 years and over | 3012 289 |
| People born in Australia | 15 017 847 |
| People who speak English only | 16 509 291 |

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- i) What was the total population of Australia on census day 2011?
- ii) According to the values in the table, how many people were not born in Australia?
- iii) Express the male population as a proportion of the entire population. Give your answer as a decimal. (Divide the male population by the total population). Repeat this for the female population.
- iv) How many people were aged 14 years and younger?

The table below shows the same characteristics from the first table, but it relates to Victoria only.

| Characteristics | Total persons |
|-------------------------------|---------------|
| Males in Australia | 2 632 619 |
| Females in Australia | 2 721 423 |
| People aged 15 years and over | 4 355 249 |
| People aged 65 years and over | 761 580 |
| People born in Australia | 3 670 933 |
| People who speak English only | 3 874 861 |

- v) What was the population of Victoria on the census day 2011?
- vi) Express both the male and female population of Victoria as a proportion of the total population of the state.
- vii) How does the population of males and females in Victoria compare with the proportion of males and females in the entire Australia population?
- viii) Compare the other characteristics in the table with those for the entire population.

| Characteristics | Total persons |
|---------------------------|---------------|
| Males in Australia | 1 977 928 |
| Females in Australia | 1 795 873 |
| People living in Victoria | 1 201 070 |
| People born in Australia | 2 908 303 |

The Australia Bureau of Statistics (ABS) websites (www.abs.gov.au) can be used to investigate other characteristics from the 2011 census.

- ix) How much did Australia's population grow in the 105 years since 1901?
- x) Compare the proportion of people born in Australia at the 1901 census with the 2011 census?

Question 3

[10 marks]

The Golden ratio – Ratio and rates

The Greeks believed that using a special ratio of numbers in building designs, paintings, sculptures etc. would automatically make them beautiful. This number is known as the golden ratio or golden number.

Part A

The human body has many examples of the golden ratio.

The golden number = $\frac{\sqrt{5} + 1}{2}$

- i) Work out this number as a decimal to 3 decimal places (3dp).

The golden ratio is often represented by Greek symbol phi (Φ). One of the interesting relationships of this ratio to the design of the human body is that there are:

- Five appendages on the torso: arms, legs and head
- Five appendages on each of these: fingers, toes and five openings on the face
- Five senses: sight, hearing, touch, taste and smell.

The golden number is also based on 5 because the number phi can be

written as: $5^{0.5} \times 0.5 + 0.5$

Leonardo da Vinci’s drawings of the human body emphasized its proportions. The ratios of the following distances equal the golden ratio:

- Foot to navel: navel to head
- Length of forearm: length of hand
- Length of upper arm: length of hand and forearm.

Your task is to explore the golden ratio as it applies to your body.

Ask someone to assist you in collecting the data/ measure parts of your body. Next in the table below are some the measurements you could take. Choose other parts of your body to measure and find as many golden ratios as possible.

| Body measurements (cm) | Ratio | Decimal value |
|---|-------|---------------|
| Foot to navel: navel to head | | |
| Length of forearm: length of hand | | |
| Length of upper arm: length of hand and forearm | | |
| | | |
| | | |
| | | |

Question 4

[5 marks]

The composition of Gold – Application of Percentages

You may be aware that most gold jewellery is not made of pure gold. It is actually an alloy, or mixture of metals. The finest gold used in jewellery is 24 carat and known as fine gold. Gold in this form is very soft and is easily scratched. Most metals will form an alloy with gold, the most common being silver, copper and zinc in jewellery making. Other metals may be used to create coloured gold. A table of the composition of some of the common gold alloys used in jewellery pieces is shown below.

| Gold name | Composition | |
|-------------------------------|-------------|--------|
| Gold (24 carat) | Gold | 100% |
| Yellow gold (22 carat) | Gold | 91.67% |
| | Silver | 5% |
| | Copper | 2% |
| | Zinc | 1.33% |
| Pink gold (18 carat) | Gold | 75% |
| | Copper | 20% |
| | Silver | 5% |
| Rose gold (18 carat) | Gold | 75% |
| | Copper | 22.25% |
| | Silver | 2.75% |
| Red gold (18 carat) | Gold | 75% |
| | Copper | 25% |
| White gold (18 carat) | Gold | 75% |
| | Palladium | 10% |
| | Nickel | 10% |
| | Zinc | 5% |
| Gray-white gold (18 carat) | Gold | 75% |
| | Iron | 17% |
| | Copper | 8% |
| Green gold (18 carat) | Gold | 75% |
| | Silver | 20% |
| | Copper | 5% |
| Blue gold (18 carat) | Gold | 75% |
| | Iron | 25% |
| Purple gold (18 carat) | Gold | 80% |
| | Aluminium | 20% |

Use the table to answer the following questions

- i) Study the table and list the metals used to create the alloys of gold mentioned.
- ii) A particular rose-gold bracelet weighs 36 grams. Calculate the masses of the various components in the bracelet.
- iii) How much more gold would be in yellow-gold bracelet of the same mass? What fraction is this of the mass of the bracelet?
- iv) Pink, rose and red gold all contain 75% gold. In addition, they contain copper, and pink and rose gold also contain silver. Describe the effect you feel the composition of the alloy has on the color of the gold.

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- v) Why does white gold not contain any copper?
- vi) Compare the composition of the alloys in red gold and blue gold.
- vii) 24-carat gold is classed as 100% gold. On this basis, an alloy of gold containing 75% gold has a carat value of 18 carat. Note this fact in the table above. The purple gold is 80% gold. What would its carat value be?
- viii) Just as there are various qualities of gold used in jewellery making, the same is true of silver jewellery. Sterling silver, which is commonly used, is actually not pure silver. Find out the composition of silver used in jewellery making. Write a short report on your findings on a separate sheet of paper.

TOTAL:

Comments:

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Year 8 Mathematics – Problem Solving

| | Well below standard (1) | Below standard (2) | Standard (3) | Above standard (4) | Well above standard (5) |
|--------------------------|---|--|--|--|---|
| Question 1 | Able to complete 1 part of question one partially. Able to describe one process used in problem solving. Gives none or one of the methods briefly used in problem solving | Able to complete 2 parts of question one but partially. Able to describe 2 processes used in problem solving. Gives 1 example of the methods used in problem solving | Able to complete 2 parts of question one partially. Able to describe two processes used in problem solving. Gives examples of some the methods used in problem solving | Able to complete all parts of question one correctly. Able to describe most processes used in problem solving. Gives examples of most of the methods used in problem solving | Able to complete all parts of question one correctly. Able to describe all the processes used in problem solving. Gives examples of all the methods used in problem solving |
| Question 2 | Able to complete 2 parts of question 2 correctly. Able to describe one process used in problem solving. Gives none or one of the methods briefly used in problem solving | Able to complete 4 parts of question 2 correctly . Able to describe 2 processes used in problem solving. Gives 1 example of the methods used in problem solving | Able to complete 6 parts of question 2 correctly . Able to describe two or more processes used in problem solving. Gives examples of some the methods used in problem solving | Able to complete 8 parts of question 2 correctly. Able to describe most processes used in problem solving. Gives examples of most of the methods used in problem solving | Able to complete all parts of question 2 correctly. Able to describe all the processes used in problem solving. Gives examples of all the methods used in problem solving |
| Question 3 Part A | Able to complete few parts of question 3, part A partially. Fills the Ratio and Decimal Value column of the table incorrectly/ or without any working. Able to describe one process used in problem solving. Gives none or one of the | Able to complete all parts of question 3, Part A correctly for at least 3 different combinations . Able to describe 2 processes used in problem solving. Gives 1 example of the methods used in problem solving | Able to complete all parts of question 3, Part A correctly for at least 4 different combinations. Able to describe two or more processes used in problem solving. Gives examples of some the methods | Able to complete all parts of question 3, Part A correctly for at least 5 different combinations. Able to describe most processes used in problem solving. Gives examples of most of | Able to complete all parts of question 3, Part A correctly for at least 5 or more different combinations. Able to describe all the processes used in problem solving. Gives examples of all the methods used in problem solving |

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| | methods briefly used in problem solving | | used in problem solving | the methods used in problem solving | |
|--|---|--|---|---|---|
| Question 3 Part B | Able to complete first quarter of the table of question 3, part B correctly. Able to describe one process used in problem solving. Gives none or one of the methods briefly used in problem solving | Able to complete 40% (8 columns and 8 rows) of the table of question 3, part B correctly. Able to describe 2 processes used in problem solving. Gives 1 example of the methods used in problem solving | Able to complete 50% (10 columns and 10 rows) of the table of question 3, part B correctly. Able to describe two or more processes used in problem solving. Gives examples of some the methods used in problem solving | Able to complete 80% (16 columns and 16 rows) of the table of question 3, part B correctly. Able to describe most processes used in problem solving. Gives examples of most of the methods used in problem solving | Able to complete 100% (20 columns and 20 rows) of the table of question 3, part B correctly. Able to describe all the processes used in problem solving. Gives examples of all the methods used in problem solving |
| Question 4 | Able to complete 2 parts of question 4 correctly. Able to describe one process used in problem solving. Gives none or one of the methods briefly used in problem solving | Able to complete 4 parts of question 4 correctly . Able to describe 2 processes used in problem solving. Gives 1 example of the methods used in problem solving | Able to complete 6 parts of question 4 correctly . Able to describe two or more processes used in problem solving. Gives examples of some the methods used in problem solving | Able to complete 7 parts of question 4 correctly. Able to describe most processes used in problem solving. Gives examples of most of the methods used in problem solving | Able to complete all parts of question 4 correctly. The short report is correct and meaningful, where the composition of an alloy or mixture of metals are well explained. Able to describe all the processes used in problem solving. Gives examples of all the methods used in problem solving |

Introduction to problem solving - create a table

Introduction to problem solving

- When solving problems, the main processes that we can use are as follows:
 1. Read the question at least twice and take note of all the important facts.
 2. Identify the solution required
 3. Solve the problem using an appropriate strategy
 4. Communicate the solution using appropriate language and mathematical terms.
 5. Support the solution with mathematical reasoning.
 6. Reflect on the solution. Does it answer the question, and does it make sense? Could it have been solved a better way?
- The problem-solving processes are interrelated. The importance of each will depend on the problem being solved. By practicing the skills involved in using processes, you will learn to tackle new mathematics problems with confidence and arrive at the correct and complete solution using the most appropriate methods.
- **READ THE QUESTION** at least twice. Make sure you know what the question is asking you to do. Do you have enough information to solve the problem?
- **IDENTIFY THE SOLUTION REQUIRED:** What is the question asking you to do?
- **SOLVE THE PROBLEM** using an appropriate strategy. Decide on a suitable strategy to solve the problem. Examples of strategies that could be used are as follows:
 - Create a table
 - Draw a diagram
 - Look for a pattern – using technology
 - Work backwards from the answer
 - Elimination
 - Simplify the problem
 - Guess and check
- **COMMUNICATE THE SOLUTION:** Another person reading your work needs to be able to follow your method or strategy. You need to present your data, explanation and solutions in a clear and concise form, using correct mathematical terms and appropriate diagrams.
- **SUPPORT THE SOLUTION with mathematical reasoning.** When you think you've solved the problem, use mathematical reasoning to verify that your answer is correct, and your method is justified.

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- **REFLECT ON THE SOLUTION:** Have you answered the question? Think back over how you solve the problem. Could it have solved in a different or better way? Learn from the experience and use this knowledge to solve problems in the future.

Create a table

- A table is a way of organizing or grouping numbers.
- Think about the number of rows or columns that will be needed and label them appropriately
- A table can help you see patterns in the number you have organized.
- A table can demonstrate to others how you arrived at your solution.
- There are many ways of presenting information in a table.