Fluency

Portfolio summary

In F–2, students become fluent as they develop skills in choosing appropriate procedures; and recalling factual knowledge and concepts readily.

In Years 3–6, students become fluent as they develop skills in choosing appropriate procedures; carrying out procedures flexibly and accurately; and recalling factual knowledge and concepts readily. Students are fluent when they calculate answers efficiently, when they recognise robust ways of answering questions, and when they recall definitions and regularly use facts.

In Years 7–8, students develop skills in choosing appropriate procedures; carrying out procedures flexibly, accurately, efficiently and appropriately; and recalling factual knowledge and concepts readily. Students are fluent when they calculate answers efficiently, when they recognise robust ways of answering questions, when they choose appropriate methods and approximations, and when they recall definitions and regularly use facts.

In Years 9–10, students develop skills in choosing appropriate procedures; carrying out procedures flexibly, accurately, efficiently and appropriately; and recalling factual knowledge and concepts readily. Students are fluent when they calculate answers efficiently, when they recognise robust ways of answering questions, when they choose appropriate methods and approximations, when they recall definitions and regularly use facts, and when they can manipulate expressions and equations to find solutions.

Number and algebra: Who are we?

Sample summary

The learning intention of the task was to identify given numbers which occur before and after a given number on a hundreds number chart.

Proficiencies

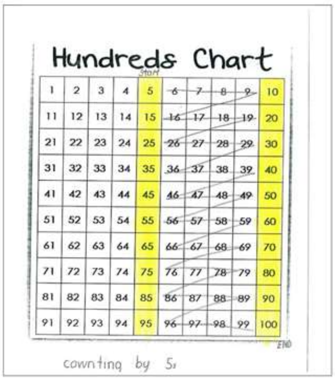
Understanding

Fluency

Reasoning

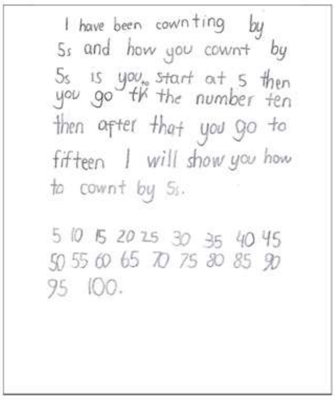
At this year level understanding includes connecting names, numerals and quantities, and partitioning numbers in various ways.

Hundreds chart



Annotations

1 Fluency
Carries out skip counting by fives from zero accurately



Annotations

1 Understanding
Identifies and represents appropriately on a hundreds chart the sequence of numbers (multiples of five) obtained

2 Reasoning
Explains the strategy used to skip count by fives from zero and demonstrates the results of using the strategy by listing the appropriate sequence of numbers to 100

Number and algebra: Fractions and decimals and percentages

Sample summary

Students were given the following problem to solve:

‘A school is enclosed by a fence that has sides of equal length. 60% of the whole fence has been painted black. How many different ways can you draw what the fence might look like? Look at each of your drawings and represent the painted section as a fraction. Represent it as a decimal.'

Proficiencies

Understanding

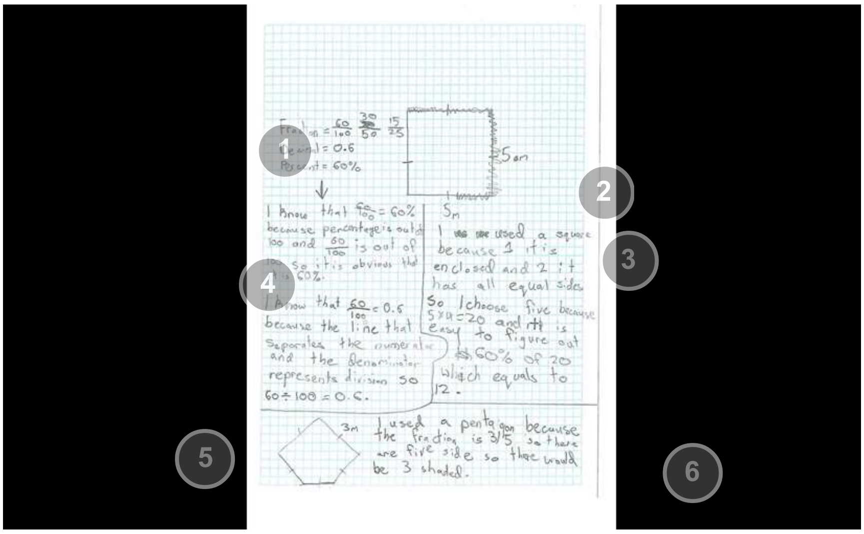
Fluency

Problem-Solving

Reasoning

At this year level understanding includes describing properties of different sets of numbers, using fractions and decimals to describe probabilities, representing fractions and decimals in various ways and describing connections between them, and making reasonable estimations.

Worksheet



Annotations

1 **Fluency**
Connects the concepts of percentage, fraction and decimal by accurately representing 60% as a fraction and a decimal and explains why the representations are equal

2 **Problem-Solving**
Chooses the side length of the square to be 5 metres, with the explanation that ‘it is easy to figure out 60% of 20’ following calculation of the perimeter of the square (20 metres)

3 **Reasoning**
Justifies the choice of a square as an appropriate shape for the area to be fenced

4 **Understanding**
Accurately calculates 60% of the perimeter of the fence (painted part) to be 12 (metres) and accurately represents the length of the painted part on a diagram representing the fence

5 **Understanding**
Recalls that the square and the regular pentagon are

shapes that have all of their sides of equal length

6 **Reasoning**
Justifies the choice of a regular pentagon as an alternative shape for the area to be fenced and correctly identifies the number of sides of the fence (3 of 5) that would be painted

Measurement and geometry: Dimensions of a 3D object

Sample summary

Students were asked to determine the dimensions of a box given the length of ribbon of 1.2 metres needed to wrap around the parcel.

Proficiencies

Understanding

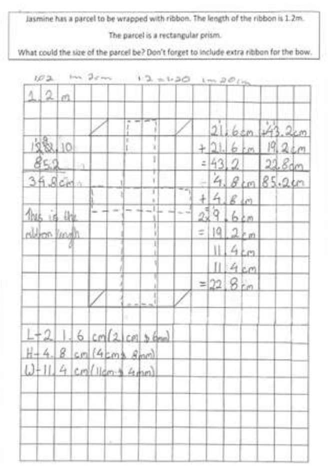
Fluency

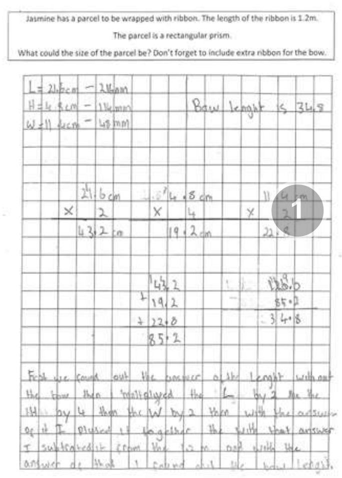
Problem-Solving

Reasoning

At this year level understanding includes describing properties of different sets of numbers, using fractions and decimals to describe probabilities, representing fractions and decimals in various ways and describing connections between them, and making reasonable estimations.

Worksheet





Annotations

1 **Understanding**
Represents the amount of ribbon (without bow) to be used to wrap the parcel as appropriate multiples of its length, breadth and height

2 **Fluency**
Calculates efficiently and accurately the amount of ribbon (without bow) required for wrapping the parcel and the amount of ribbon remaining for the bow, and describes the strategies used

Student demonstration

Number and algebra: Game show – Licence to solve

Sample summary

Students participated in a dice rolling game where they rolled two number dice and an operation die to determine the mathematical operation to be performed. The winner was the student with the highest number.

Proficiencies

Understanding

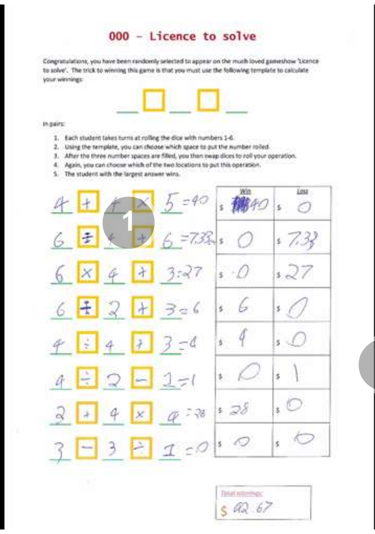
Fluency

Problem-Solving

Reasoning

At this year level understanding includes describing patterns in uses of indices with whole numbers, recognising equivalences between fractions, decimals, percentages and ratios, plotting points on the Cartesian plane, identifying angles formed by a transversal crossing a pair of lines, and connecting the laws and properties of numbers to algebraic terms and expressions.

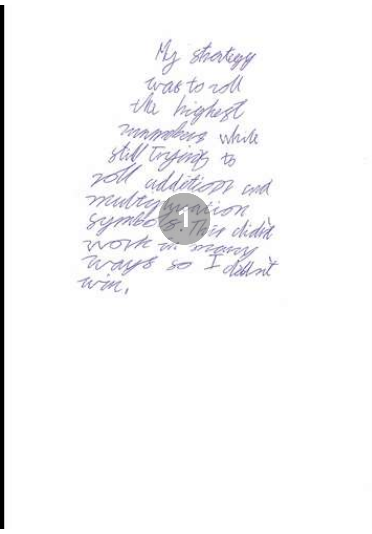
Worksheet



Annotations

1 **Understanding**
In analysing and interpreting the problem, connects knowledge of the order of operations to develop a strategy for placing the numbers and operations rolled on the dice into the given template

2 **Fluency**
Applies the order of operations appropriately in accurately calculating each of the different answers, and accurately determines the corresponding 'Win' or 'Loss' and the 'Total winnings'



Annotations

1 **Reasoning**
Describes the strategy used and provides a statement of justification for the strategy

Number and algebra: Simplifying fractions

Sample summary

Students were asked to solve a problem, where they had to determine the missing numerator in a fraction. They were given a set of clues to calculate the numerator.

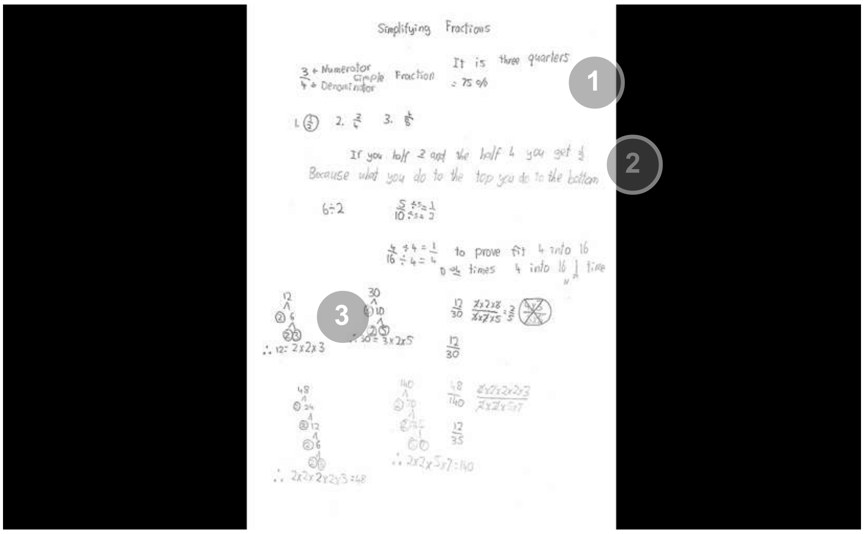
Proficiencies

Understanding

Fluency

At this year level understanding includes describing patterns involving indices and recurring decimals, identifying commonalities between operations with algebra and arithmetic, connecting rules for linear relations with their graphs, explaining the purpose of statistical measures and explaining measurements of perimeter and area.

Worksheet

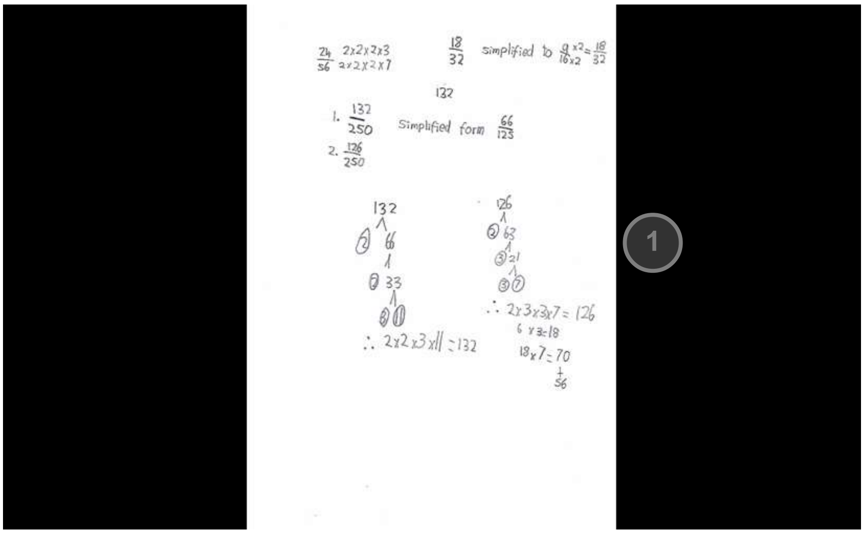


Annotations

1 **Fluency**
Identifies different parts of the fractions

2 **Understanding**
Describes operations on the fraction to create equivalent fractions

3 **Understanding**
Reduces a number to the product of its prime factors



Annotations

1 **Understanding**
Uses the reduction of the fraction to its prime factors to simplify the fraction

Measurement and geometry: Equal areas

Sample summary

Students were asked to justify the conditions for when a kite and a trapezium would have the same area.

Proficiencies

Understanding

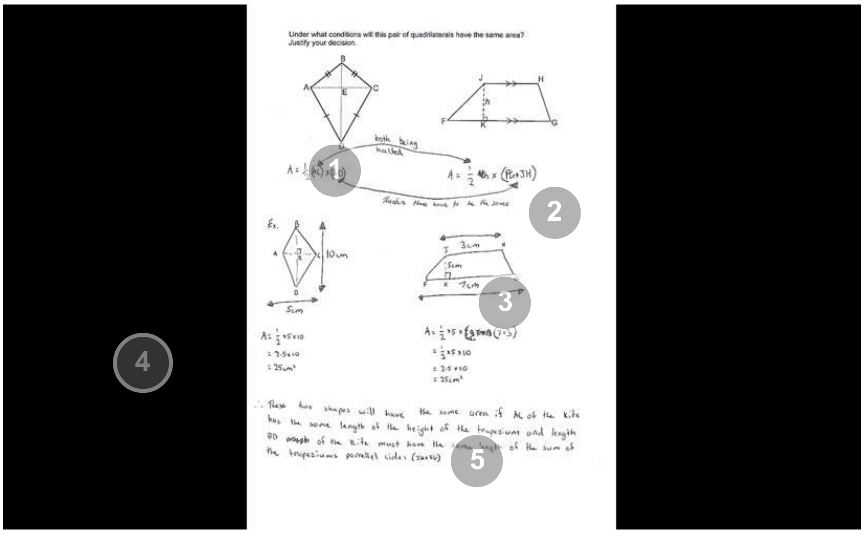
Fluency

Problem-Solving

Reasoning

At this year level understanding includes describing patterns involving indices and recurring decimals, identifying commonalities between operations with algebra and arithmetic, connecting rules for linear relations with their graphs, explaining the purpose of statistical measures and explaining measurements of perimeter and area.

Worksheet



Annotations

1 Fluency
Recalls the area formula for a kite and for a trapezium and expresses the formulas in relation to the given diagrams

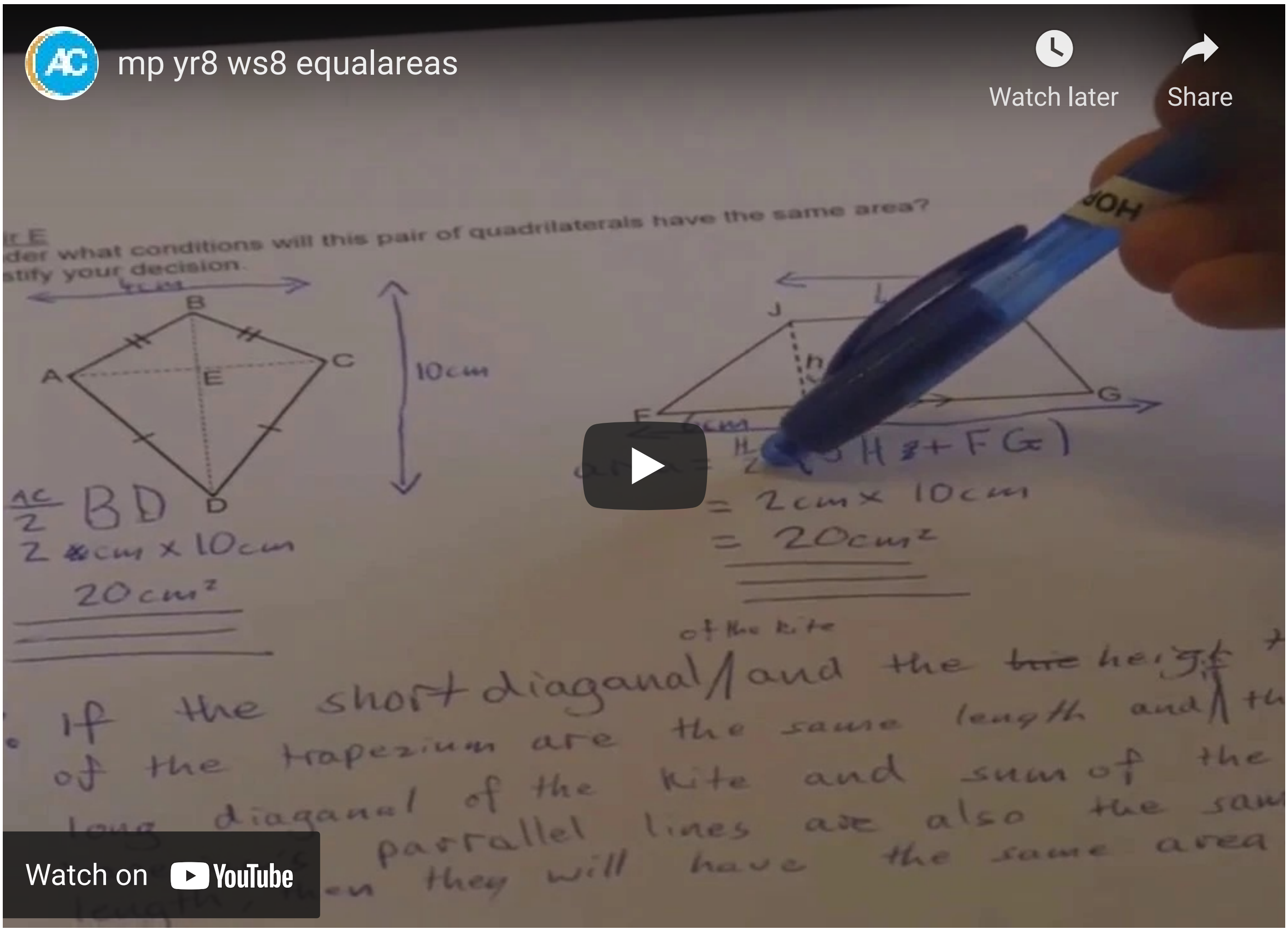
2 Reasoning
Investigates the conditions under which a kite and a trapezium will have the same area by comparing the components of the respective area formulas

3 Problem-Solving
Deduces that if a kite and a trapezium are such that the length of one diagonal of the kite is equal to height of the trapezium then, for the areas to be equal, the length of the other diagonal of the kite must be the same as the sum of the lengths of the parallel sides of the trapezium

4 Understanding
Chooses appropriate dimensions for a kite and a trapezium to demonstrate the truth of the conclusion reached

5 **Reasoning**
Makes a statement that describes and generalises the condition for a kite and a trapezium to have the same area

Student demonstration



Number and algebra: Archers in the plane

Sample summary

Students were asked to find the coordinates of a point where an archery target could be placed such that it is equidistant from three archers.

Proficiencies

Understanding

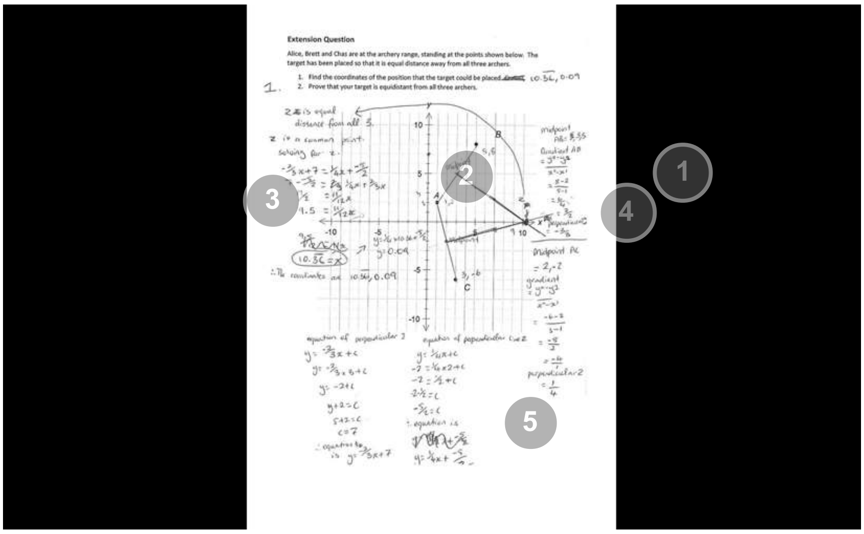
Fluency

Problem-Solving

Reasoning

At this year level understanding includes describing the relationship between graphs and equations, simplifying a range of algebraic expressions and explaining the use of relative frequencies to estimate probabilities and of the trigonometric ratios for right-angle triangles.

Worksheet



Annotations

1 **Fluency**
Calculates the midpoints and gradients of the intervals accurately and the gradients of the respective perpendicular bisectors of the intervals through the use of recalled formulas

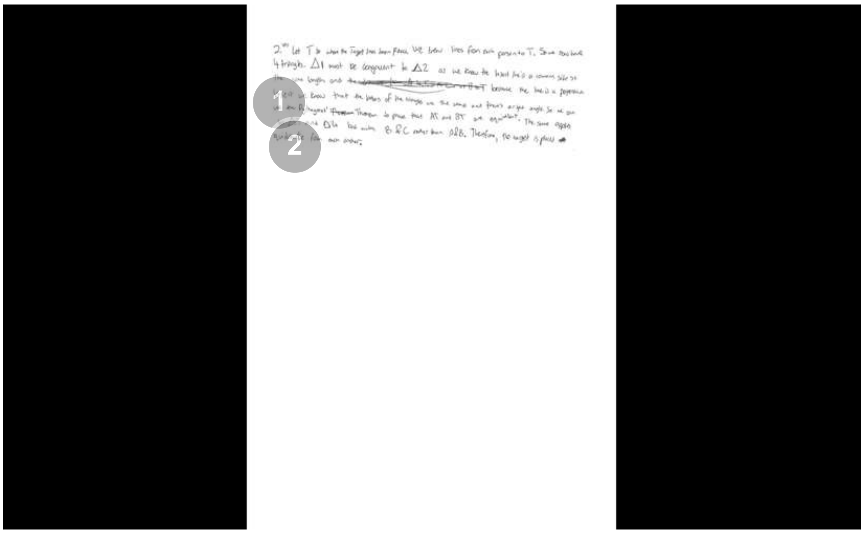
2 **Understanding**
Connects the relevant plane geometry and coordinate geometry concepts by identifying the need to determine the respective midpoints and gradients of the intervals

3 **Understanding**
Identifies the need to determine the respective equations of the perpendicular bisectors of the intervals to determine the coordinates of the position in which the target should be placed

4 **Understanding**
Interprets the problem as a geometric problem involving the intersection of the perpendicular bisectors of the intervals joining points A and B and points A and C

5 **Problem-Solving**
Determines the equations of the perpendicular

bisectors accurately, solves the equations simultaneously to determine their point of intersection, and communicates the solution effectively



Annotations

1 **Understanding**
Connects congruency of triangles, Pythagoras' Theorem and distance on the Cartesian plane to establish a proof that the target has been located to be equidistant from all three archers

2 **Reasoning**
Describes and justifies the strategy used to determine the point equidistant from all three archers

Student demonstration

Statistics and probability: Baffling box plots

Sample summary

From a given set of information about two footballers, students were asked to determine which footballer was more worthy of a reward. Students had to provide justification for their decision.

Proficiencies

Understanding

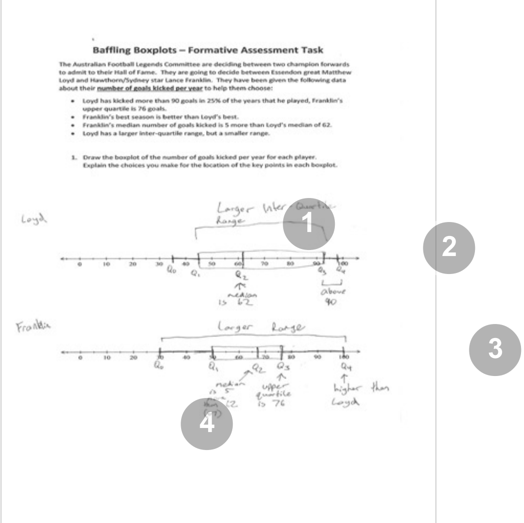
Fluency

Problem-Solving

Reasoning

At this year level understanding includes applying the four operations to algebraic fractions, finding unknowns in formulas after substitution, making the connection between equations of relations and their graphs, comparing simple and compound interest in financial contexts and determining probabilities of two- and three-step experiments.

Worksheet



Baffling Boxplots – Formative Assessment Task

The Australian Football Legends Committee are deciding between two champion forwards to admit to their Hall of Fame. They are going to decide between Essendon great Matthew Loyd and Hawthorn/Sydney star Lance Franklin. They have been given the following data about their **number of goals kicked per year** to help them choose:

- Loyd has kicked more than 90 goals in 25% of the years that he played, Franklin's upper quartile is 76 goals.
- Franklin's best season is better than Loyd's best.
- Franklin's median number of goals kicked is 5 more than Loyd's median of 62.
- Loyd has a larger inter-quartile range, but a smaller range.

1. Draw the boxplot of the number of goals kicked per year for each player. Explain the choices you make for the location of the key points in each boxplot.

Annotations

1 Fluency

Represents a larger interquartile range and smaller range for Loyd than for Franklin following appropriate choice of lower quartiles and minimum values

2 Understanding

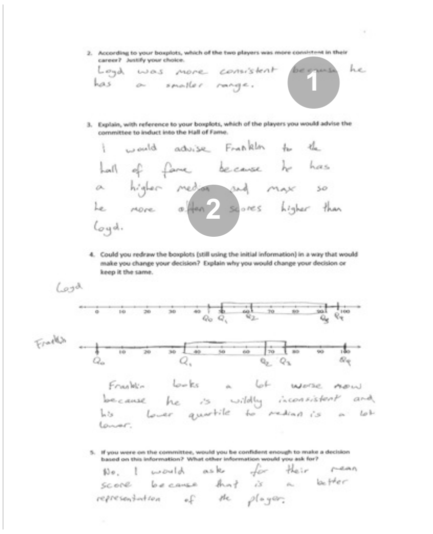
Chooses and represents appropriate upper quartile for Loyd and appropriate maximum value ('best season') for Franklin that is higher than maximum value for Loyd

3 Understanding

Represents upper quartile for Franklin and represents median for Loyd and for Franklin

4 Reasoning

Explains location of medians, and upper quartile for Franklin, and chosen locations of upper quartile for Loyd, maximum values, lower quartiles and minimum values through annotations on the boxplots



2. According to your boxplots, which of the two players was more consistent in their career? Justify your choice.

Loyd was more consistent because he has a smaller range.

1

3. Explain, with reference to your boxplots, which of the players you would advise the committee to induct into the Hall of Fame.

I would advise Franklin to the hall of fame because he has a higher median and max so he more often scores higher than Loyd.

2

4. Could you redraw the boxplots (still using the initial information) in a way that would make you change your decision? Explain why you would change your decision or keep it the same.

Loyd

0 10 20 30 40 50 60 70 80 90 100

Q_0 Q_1 Q_2 Q_3 Q_4

Franklin

0 10 20 30 40 50 60 70 80 90 100

Q_0 Q_1 Q_2 Q_3 Q_4

Franklin looks a lot worse now because he is wildly inconsistent and his lower quartile to median is a lot lower.

5. If you were on the committee, would you be confident enough to make a decision based on this information? What other information would you ask for?

No, I would ask for their mean score because that is a better representation of the player.

Annotations

1 **Reasoning**

Compares the two boxplots and justifies the choice of more consistent player by referring to the difference in range

2 **Reasoning**

Compares the two boxplots and justifies the choice of inductee by referring to the difference in median and the difference in maximum value