MATHEMATICS
2A/2B

Calculator-free

WACE Examination 2012

Marking Key

Marking keys are an explicit statement about what the examiner expects of candidates when they respond to a question. They are essential to fair assessment because their proper construction underpins reliability and validity.

When examiners design an examination, they develop provisional marking keys that can be reviewed at a marking key ratification meeting and modified as necessary in the light of candidate responses.

Section One: Calculator-free **(50 Marks)**

Question 1 **(12 marks)**

(a) Evaluate:

(i) $0.2 + 0.17$ (1 mark)

Solution
0.37
Specific behaviours
✓ calculates the correct answer

(ii) $16 \div 0.25$ (1 mark)

Solution
64
Specific behaviours
✓ calculates the correct answer

(iii) 70% of 24 (1 mark)

Solution
16.8
Specific behaviours
✓ calculates the correct answer

(iv) $10 - 3 \times 4 + 5$ (2 marks)

Solution
$10 - 3 \times 4 + 5$ $= 10 - 12 + 5$ $= -2 + 5$ $= 3$
Specific behaviours
✓ applies the rule of order correctly by first multiplying   ✓ calculates the correct answer

(b) Simplify the following expressions:

(i) $3 \times k \times k - 3 \times k$ (1 mark)

Solution
$3k^2 - 3k$
Specific behaviours
✓ simplifies correctly

(ii) $5k^2 - 2k + 2k^2 - 5k$ (1 mark)

Solution
$7k^2 - 7k$
Specific behaviours
✓ simplifies correctly

(iii) $(3 + k)(3 + 2k)$ (2 marks)

Solution
$9 + 6k + 3k + 2k^2$ $= 9 + 9k + 2k^2$
Specific behaviours
✓ expands the binomial correctly   ✓ adds like terms correctly

(c)   A number sequence is described using the recursive equation:

$$T_{n+1} = T_n + 12, \quad T_3 = 43$$

(i)   Determine T_4. (1 mark)

Solution
$43 + 12 = 55$
Specific behaviours
✓ calculates the correct answer

(ii)   Determine T_1. (2 marks)

Solution
$43 - 12 - 12 = 19$
Specific behaviours
✓ subtracts to find previous terms or sets up a linear equation to solve for T_1
✓ calculates the correct answer or solves linear equation correctly

Question 2 **(7 marks)**

(a) Given the expression $\dfrac{403 \times 94}{18.47}$

 (i) Estimate the value of the above expression by first rounding each of the numbers to the nearest ten. (2 marks)

Solution
$\dfrac{400 \times 90}{20} = 1800$
Specific behaviours
✓ rounds all three numbers to nearest ten
✓ calculates the correct answer

 (ii) A calculator could be used to evaluate the above expression. If this was done, would you find your estimated value to be smaller or larger than the calculated value? Give reasons for your answer. (2 marks)

Solution
Smaller than, as each term in the numerator has been rounded down and the denominator has been rounded up (dividing by a bigger number makes the answer smaller)
Specific behaviours
✓ states the answer is smaller
✓ states the numerator is smaller after rounding or the denominator is larger after rounding or dividing a smaller number by a larger number will result in an answer smaller than the original.

(b) Each of the numbers $3, 5, 8$ and 29 can be written in terms of the other three.

 For example $5 = 29 - 8 \times 3$.

 Write each of $3, 8$ and 29 in terms of the other three numbers. You may use brackets and any of the number operations. (3 marks)
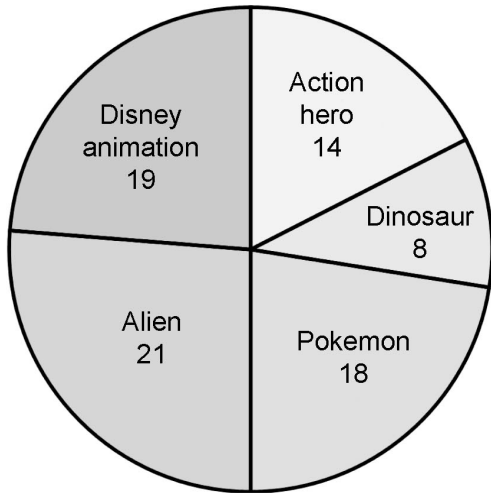
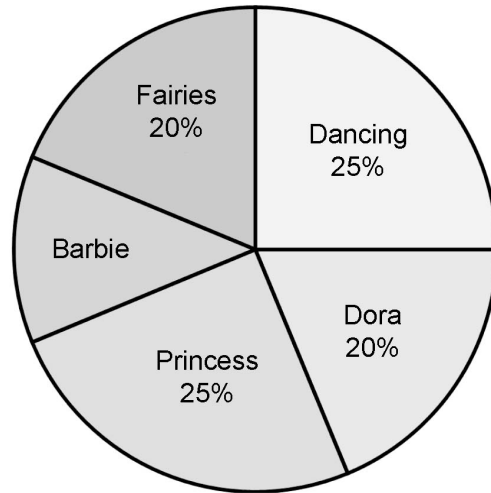| Solution |
|---|
| $29 = 5 + 3 \times 8$ |
| $8 = (29 - 5) \div 3$ |
| $3 = (29 - 5) \div 8$ |
| **Specific behaviours** |
| ✓✓✓ applies correctly the rule of order to determine an appropriate equation for each number (one mark each) |

Question 3 **(7 marks)**

Brandon and Karissa have classified the DVDs that they own into five categories each, according to the pie charts below.

Brandon's DVD collection   **Karissa's DVD collection**

(a)   What percentage of Karissa's DVD collection are Barbie DVDs?   (1 mark)

Solution
10%
Specific behaviours
✓ calculates the correct percentage

(b)   What percentage of Brandon's DVD collection are Pokemon DVDs?   (2 marks)

Solution
$\dfrac{18}{80} = 22.5\%$
Specific behaviours
✓ determines the fraction
✓ calculates the correct percentage

(c)   Karissa has eight Dora DVDs. How many Princess DVDs does she have?   (2 marks)

Solution
$DVD : \%DVD$ $8 : 20$ $x : 25$ $x = 10$ or $\dfrac{8}{x} = \dfrac{20}{25}$ $x = 10$
Therefore $x = 10$, so Karissa has 10 Princess DVDs
Specific behaviours
✓ links percentage of DVDs to total or applies ratios
✓ calculates the correct answer

(d)   Circle the correct response and justify your choice.

A: The person with the most number of DVDs is Brandon.

B: The person with the most number of DVDs is Karissa.

C: There is not enough information to determine who has the most number of DVDs.

D: Brandon and Karissa both have the same number of DVDs   (2 marks)

Solution
A: The person with the most number of DVDs is Brandon as Brandon has 80 and Karissa has 40.
Specific behaviours
✓ determines the correct answer
✓ links mathematical result in explanation

Question 4 **(7 marks)**
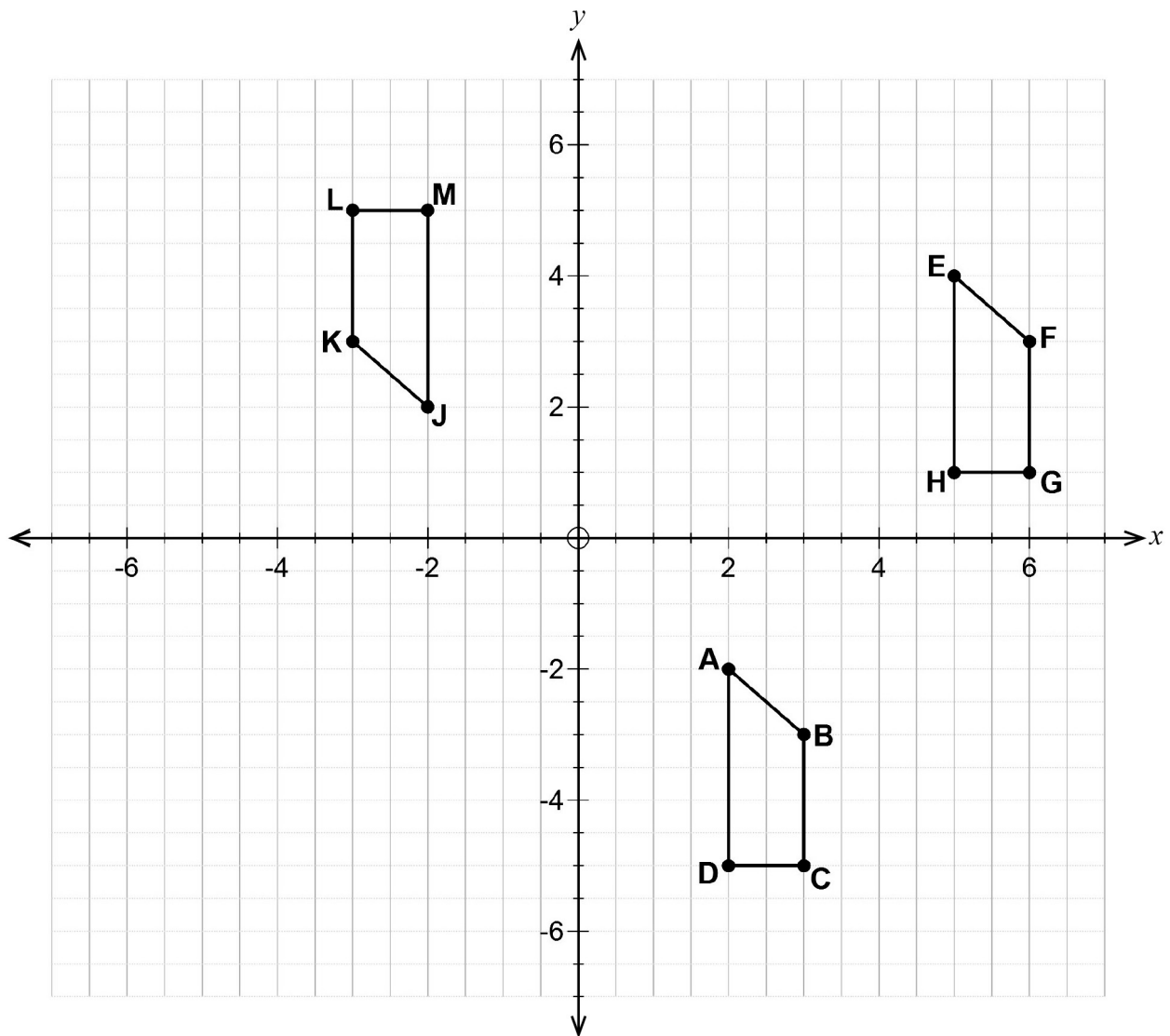
(a) Describe the transformation(s) of quadrilateral ABCD required to produce quadrilateral EFGH. (2 marks)
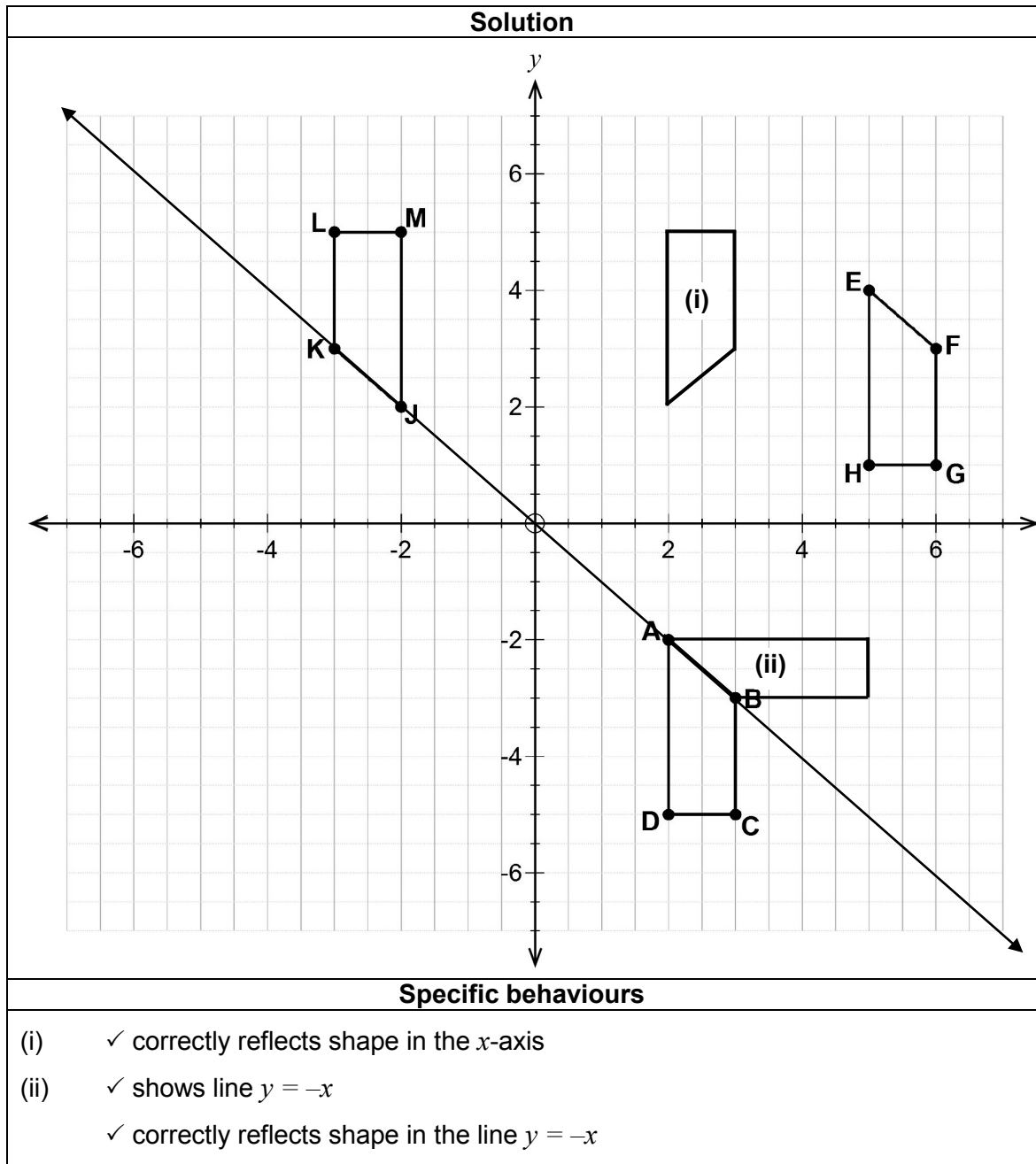
Solution
Translation 3 units right and 6 units up
Specific behaviours
✓ states 'translates right and up'
✓ states the correct number of units
or
✓ states 'translates three units right'
✓ states 'translates six units up'

(b) Describe the transformation(s) of quadrilateral ABCD required to produce quadrilateral JKLM. (2 marks)

Solution
Rotation of 180 degrees about the origin or reflection in x-axis followed by reflection in y-axis
Specific behaviours
✓states rotation of 180 degrees ✓ states rotation about the origin or ✓ reflection in x-axis ✓ reflection in y-axis

(c)   On the above diagram, show the result of each of the following transformations of quadrilateral ABCD (label each answer appropriately):

      (i)   reflection in the x-axis,   (1 mark)

      (ii)   reflection in the line $y = -x$. (Hint: First draw the line $y = -x$).   (2 marks)

Solution

Specific behaviours

(i)   ✓ correctly reflects shape in the x-axis

(ii)   ✓ shows line $y = -x$

           ✓ correctly reflects shape in the line $y = -x$

Question 5 **(4 marks)**

The Voster family live in the Perth metropolitan area. In summer their home is cooled by an air cooler which, when running, uses a large amount of electricity. The air cooler is the only appliance that causes a variation in the electricity usage. The Voster's electricity account received in February 2012 (for the months of December 2011 and January 2012) was for $157.18. Electricity accounts are received every two months.

(a) Complete the graph below to show predicted electricity account amounts for the Voster family for the remainder of 2012. (2 marks)

Electricity

Solution
Electricity

Specific behaviours
✓ identifies electricity usage for August (for the months of June and July) to be less than the usage for 'June'
✓ identifies electricity usage increasing after August

(b)   If electricity prices increased by 10% in 2013, describe how the 2013 graph would
        compare with the 2012 graph.   (2 marks)

Solution
similar patterns to 2012 but taller columns due to price increases
Specific behaviours
✓ identifies the shape being similar
✓ identifies higher height of columns

Question 6   **(6 marks)**

Agnetha is m years old and Bertie is n years old.

(a)   Write algebraic equations for the following:

        (i)   Agnetha is 15 years older than Bertie.   (1 mark)

Solution
$m = n + 15$
Specific behaviours
✓ writes a correct algebraic sentence using symbols

        (ii)   Bertie's age is five years less than half of Agnetha's age.   (1 mark)

Solution
$n = \dfrac{m}{2} - 5$
Specific behaviours
✓ writes a correct algebraic sentence using symbols

(b)   It is known that Agnetha's age can be found by solving the equation

$$5(m + 3) - 55 = 3m$$

Find Agnetha's age by solving the above equation. (3 marks)

Solution
$5(m + 3) - 55 = 3m$ $5m + 15 - 55 = 3m$ $5m - 40 = 3m$ $2m = 40$ $m = 20$ Agnetha is 20 years old Alternative solution

Number	Left side	Right side	Y/N
18	50	54	N
19	55	57	N
20	60	60	Y

Agnetha is 20 years old

Specific behaviours
✓ expands correctly
✓ collects like terms and simplifies to $2m = 40$
✓ states correct age in years
Alternative solution
✓ constructs an appropriate table or list
✓ uses systematic check to left and right sides of the equation
✓ states correct age in years

(c)   Use your result from Part (b) and **one** of the equations in Part (a) to find Bertie's age.
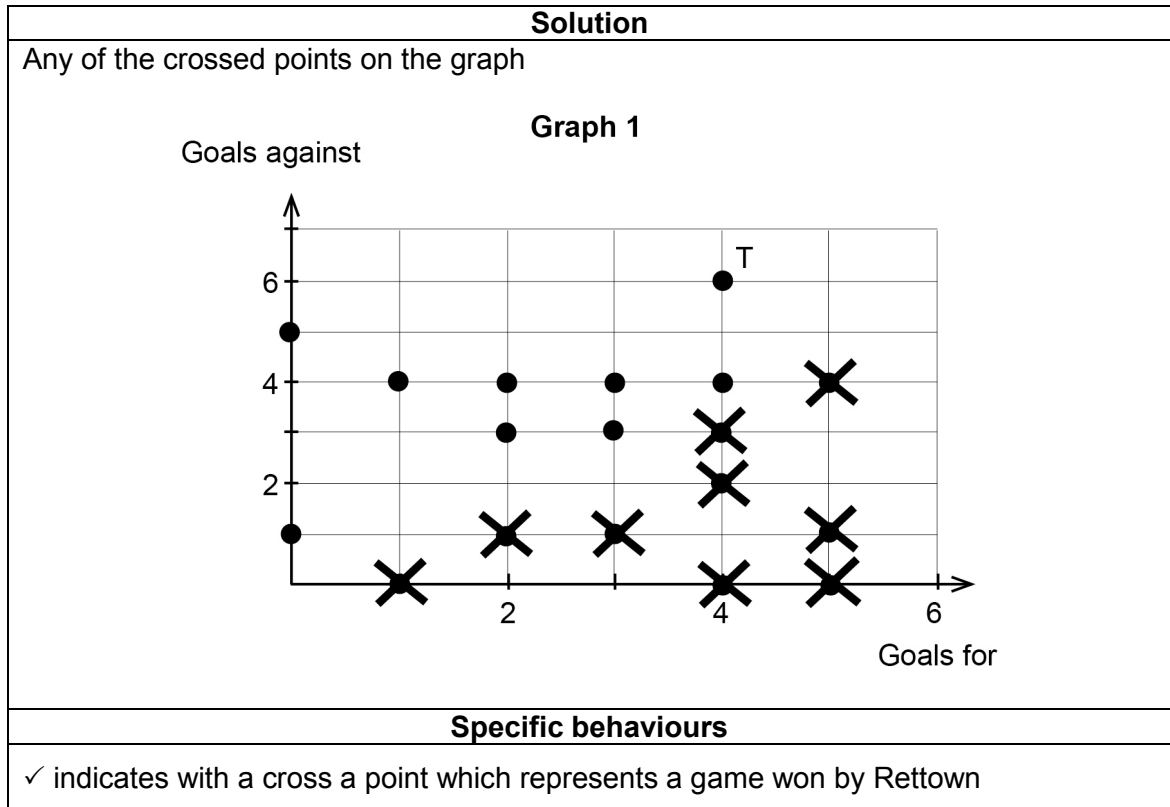
(1 mark)

Solution
$n = \dfrac{20}{2} - 5$ $\quad = 5$ Bertie is 5 years old

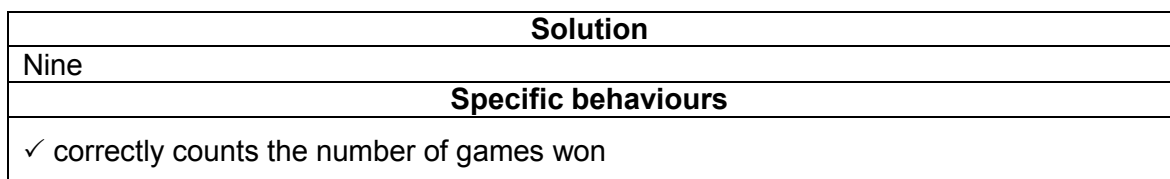| Specific behaviours |
|---|
| ✓ calculates Bertie's age based on results from Part (a) and Part (b) |

Question 7 **(7 marks)**

During one season, Rettown soccer team played 18 games with the results as shown in Graph 1. (Note: 'goals for' represents the score for Rettown, while 'goals against' represents the score for the opposition team, e.g. Point T represents a game that Rettown lost 4 goals to 6.)
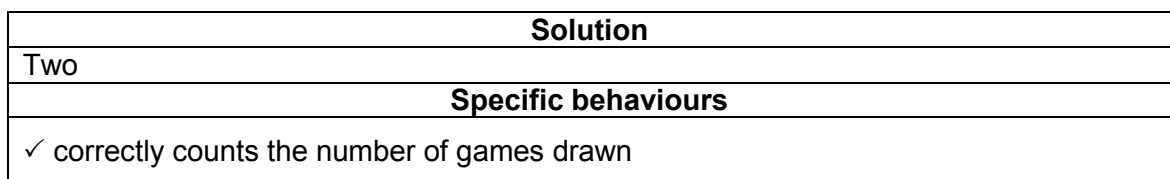
(a)   Indicate with a cross ('X') on the graph a game that was won by Rettown.   (1 mark)

Solution
Any of the crossed points on the graph

Graph 1

Specific behaviours
✓ indicates with a cross a point which represents a game won by Rettown

(b)   How many games did Rettown win?   (1 mark)

Solution
Nine
Specific behaviours
✓ correctly counts the number of games won

(c)   How many of Rettown's games ended in a draw?   (1 mark)

Solution
Two
Specific behaviours
✓ correctly counts the number of games drawn

Graph 2 below shows some of Rettown's winning margins. (Note: a negative 'winning margin' represents a loss.)

Graph 2
Number of games
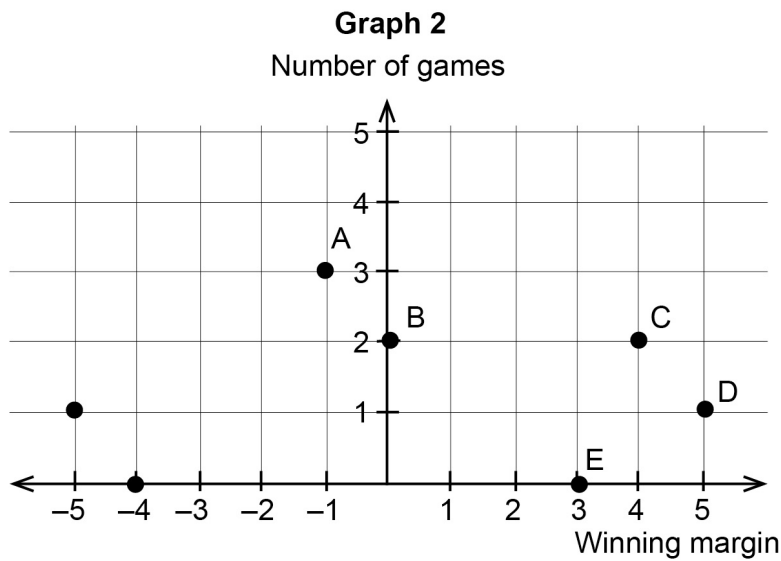
Graph 2 is incomplete, with only seven of the required eleven points shown.
- Point A represents the three games Rettown lost by one goal
- Point D represents the one game that the team won by five goals
- Point E indicates that no games were won by three goals.

(d)   What does point B on Graph 2 represent?   (1 mark)

Solution
The two drawn games
Specific behaviours
✓ interprets the meaning of the plotted point correctly

(e)   What does point C on Graph 2 represent?   (1 mark)

Solution
The two games won by 4 goals
Specific behaviours
✓ interprets the meaning of the plotted point correctly

(f)   Complete Graph 2 by plotting the remaining four 'winning margins'.   (2 marks)

Solution

Graph 2

Number of games

Specific behaviours

✓ correctly plots two points

✓ correctly plots all four points