Government of **Western Australia**
**Curriculum Council**

WACE
Western Australian Certificate of Education

# MATHEMATICS

# 2A/2B

# Calculator-free

# WACE Examination 2011

# 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.

**Question 1** **(7 marks)**

(a) Evaluate:

$15 - 12 \div 2 \times 3 + 5$ (2 marks)

| Solution |
|---|
| $15 - 12 \div 2 \times 3 + 5$<br>$= 15 - 18 + 5$<br>$= 2$ |
| **Specific Behaviours** |
| ✓ applies the rule of order for division and multiplication correctly<br>✓ carries through calculation correctly |

(b) Expand and simplify:

$(2x - 3)(x + 5)$ (2 marks)

| Solution |
|---|
| $(2x - 3)(x + 5)$<br>$= 2x^2 - 3x + 10x - 15$<br>$= 2x^2 + 7x - 15$ |
| **Specific Behaviours** |
| ✓ expands the binomial correctly<br>✓ adds like terms correctly |

(c) Estimating a calculation can be made easier by first rounding the numbers. One way to round is to round to the **leading** digit, for example, 534 rounds to 500, 39 rounds to 40 and 19 345 rounds to 20 000.

(i) Round 189 to the leading digit. (1 mark)

| Solution |
|---|
| 200 |
| **Specific Behaviours** |
| ✓ rounds correctly |

(ii) Hence, estimate the value of the calculation $189 \times 42$ by using the method of rounding to the leading digit. (1 mark)

| Solution |
|---|
| $189 \times 42$<br>$\approx 200 \times 40$<br>$= 8000$ |
| **Specific Behaviours** |
| ✓ applies specified rounding method to both factors to estimate the value correctly |

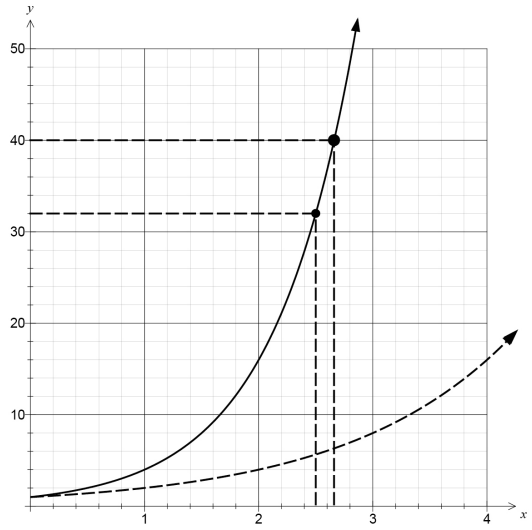


(c) On the same set of axes above sketch the graph $y = 2^x$. (2 marks)

| Solution |
|---|
| see graph |
| **Specific Behaviours** |
| ✓ plots (0,1) and at least two (2) other points correctly on the graph<br>✓ draws a smooth curve through the plotted points |

**Question 6** **(4 marks)**

On the axes below, the graph of $y = 4^x$ is plotted.




(a) Show clear use of the graph to determine the value of $4^{2.5}$. (1 mark)

| Solution |
|---|
| $4^{2.5} = 32$<br>Accept 31 – 33 |
| **Specific Behaviours** |
| ✓ reads value from graph correctly |

(b) Show clear use of the graph to determine the value of $x$ if $4^x = 40$. Give your answer to **two (2)** decimal places. (1 mark)

| Solution |
|---|
| $x \approx 2.66$<br>Accept $2.61 - 2.70$ |
| **Specific Behaviours** |
| ✓ reads value from graph correctly |

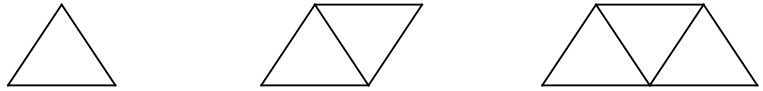


(d) Indonesia has a population of 275 million. Write this number in scientific notation.(1 mark)

| Solution |
|---|
| $275\,000\,000 = 2.75 \times 10^8$ |
| **Specific Behaviours** |
| ✓ expresses the number in scientific notation correctly |

**Question 2** **(10 marks)**

A sequence of shapes is made of matches to form triangles, as shown below.

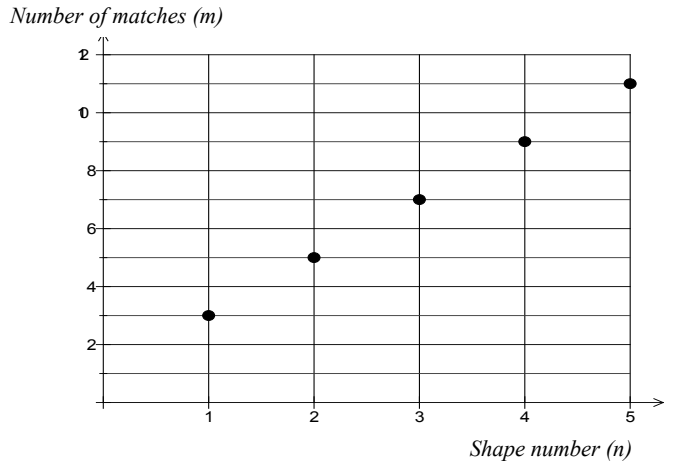


***Shape Number 1*** ***Shape Number 2*** ***Shape Number 3***

The table of results is shown below:

| Shape Number ($n$) | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Number of matches ($m$) | 3 | 5 | 7 | 9 | 11 |

(a) Plot the data from above on the axes below. (1 mark)

| Solution |
|---|
|  |
| **Specific Behaviours** |
| ✓ plots all five points correctly |

(b) Can these points be joined? Explain your answer in the context of the situation. (1 mark)

| Solution |
|---|
| No, as you can only have whole numbers for Shape Numbers. For example, shape Number 1.5 does not make sense in this context. |
| **Specific Behaviours** |
| ✓ answers 'no' and gives appropriate reason |

(c) Write a rule linking $m$ and $n$, where $m$ and $n$ are as defined in the table. (2 marks)

| Solution |
|---|
| $m = 2n + 1$ |
| **Specific Behaviours** |
| ✓ identifies gradient<br>✓ determines the correct rule in terms of $m$ and $n$ |

(d) Determine the number of matches required for Shape Number 12. (1 mark)

| Solution |
|---|
| $m = 2n + 1$<br>$= 2(12) + 1$<br>$= 25$ |
| **Specific Behaviours** |
| ✓ determines the correct value, based on response in (c) or correctly continues the pattern |

(e) Justify that the point (20, 41) lies on the line that would pass through the points plotted in (a). (1 mark)

| Solution |
|---|
| $m = 2n + 1$<br>$= 2(20) + 1$<br>$= 41$<br>therefore the point lies on the line (or not, based on response in(c)) |
| **Specific Behaviours** |
| ✓ shows when $n = 20$, $m = 41$ or consistent with response in (c) |



(c) The median price of a house in a Perth suburb at the end of 2008 was \$300 000. Due to the Global Financial Crisis, the median price dropped by 10% during 2009. During 2010, the market had regained strength and the median house price rose by 10%.

What was the median house price at the end of 2010? (3 marks)

| Solution |
|---|
| End of 2009 price $= 300\ 000 \times 0.9 = \$270\ 000$<br>End of 2010 price $= 270\ 000 \times 1.1 = \$297\ 000$<br><br>Or<br><br>End of 2009 price $= \$300\ 000 - 10\%$ of $\$300\ 000$<br>$= 300\ 000 - 30\ 000$<br>$= \$270\ 000$<br><br>End of 2010 price $= \$270\ 000 + 10\%$ of $\$270\ 000$<br>$= 270\ 000 + 27\ 000$<br>$= \$297\ 000$ |
| **Specific Behaviours** |
| ✓ calculates 10% decrease from \$300 000 correctly<br>✓ calculates a 10% increase correctly<br>✓ uses \$270 000 to calculate the percentage increase correctly |

(d) Sonya is at the supermarket to purchase muesli. She notices it is packaged in two sizes: 500 g and 275 g. The larger size costs \$5 and the smaller size \$2.45. Which is the better buy? (Assume that she doesn't mind what size she buys). Justify your answer. (2 marks)

| Solution |
|---|
| Buying two smaller muesli packets<br>Weight = 2 × 275 g = 550 g<br>Price = 2 × 2.45 = \$4.90<br>Therefore get more muesli for less money if buying the 275 g packet<br>275 g packet best buy |
| **Specific Behaviours** |
| ✓ compares weight and price correctly<br>✓ concludes 275 g packet as best buy |

**Question 5** **(10 marks)**

(a) An antique dealer paid $200 for an old ceramic jug. He decides to sell the jug with at least 60% profit. What is his minimum selling price? (2 marks)

| Solution |
|---|
| $200 \times 1.6 = \$320$ or $200 + 0.6 \times 200 = \$320$ |
| **Specific Behaviours** |
| ✓ identifies 60% profit as a 60% increase or calculates 60% of $200<br>✓ calculates selling price correctly |

(b) The profit from a family business was shared by three brothers, Paul, Greg and John, in the ratio of 3 : 2 : 1 respectively. If Paul's share was $24 000, what was the total profit? (3 marks)

| Solution |
|---|
| $P : G : J$<br>$3 : 2 : 1$<br>$24\,000 : 16\,000 : 8\,000$<br><br>Total profit $= 24\,000 + 16\,000 + 8\,000$<br>$= \$48\,000$<br><br>or Paul receives $\frac{3}{6}$ shares of the profit, therefore<br><br>Total profit $= 2 \times 24\,000$<br>$= \$48\,000$ |
| **Specific Behaviours** |
| ✓ recognises unit share or number of shares<br>✓ calculates the profit for Greg and John correctly or sees Paul's share as half<br>✓ calculates total profit correctly |



(f) Madeline has 50 matches. What is the biggest Shape Number she would be able to make? (2 marks)

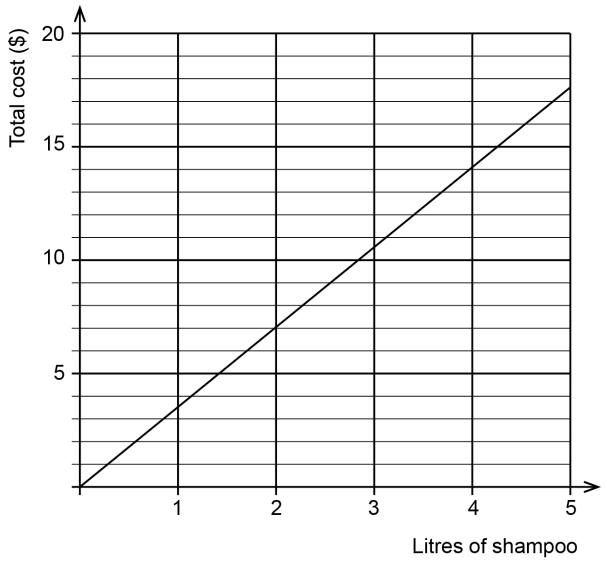
| Solution |
|---|
| $2n + 1 = 50$<br>$2n = 49$<br>$n = 24.5$<br>therefore the biggest shape number she could make is Shape Number 24. |
| **Specific Behaviours** |
| ✓ solves for $n$, correctly, based on response in (c) or uses the pattern to determmine $n$ correctly<br>✓ rounds the answer down<br>Note: Full marks for answer of 24 without working |

(g) Write a recursive rule for the original table of results. (2 marks)

| Solution |
|---|
| $T_{n+1} = T_n + 2$ where $T_1 = 3$ |
| **Specific Behaviours** |
| ✓ determines the correct recursive part of the rule |
| ✓ states $T_1$ |

**Question 3** **(3 marks)**

Cate works as an apprentice hairdresser. She has been asked to order shampoo from a bulk supplier. Her employer gives her the graph below which shows the total cost ($) of ordering a given quantity of shampoo (in litres).




(a) Determine the gradient of the line. (1 mark)

| Solution |
|---|
| $\frac{7}{2} = 3.5$ |
| **Specific Behaviours** |
| ✓ calculates the gradient of the straight line correctly |

(b) What does the value of the gradient indicate in this context? (1 mark)

| Solution |
|---|
| The price of shampoo is $3.50 per litre |
| **Specific Behaviours** |
| ✓ interprets the gradient in cost per litre |

(c) Cate has to order 12 litres of shampoo. What will this cost? (1 mark)

| Solution |
|---|
| $12 \times 3.5 = \$42$ |
| **Specific Behaviours** |
| ✓ calculates cost correctly |



**Question 4** **(6 marks)**

Solve the following equations and inequalities **algebraically**. Show all workings.

(a) $5(n + 2) = 2n + 1$ (2 marks)

| Solution |
|---|
| $5(n+2) = 2n+1$<br>$5n+10 = 2n+1$<br>$3n = -9$<br>$n = -3$ |
| **Specific Behaviours** |
| ✓ expands brackets correctly<br>✓ collects like terms correctly and states correct solution |

(b) $2k - 6 \leq 15$ (2 marks)

| Solution |
|---|
| $2k - 6 \leq 15$<br>$2k \leq 21$<br>$k \leq 10.5$ |
| **Specific Behaviours** |
| ✓ isolates $k$ correctly<br>✓ uses the correct inequality sign |

(c) $2^m + 7 = 23$ (2 marks)

| Solution |
|---|
| $2^m + 7 = 23$<br>$2^m = 16$<br>$2^m = 2^4$<br>$m = 4$ |
| **Specific Behaviours** |
| ✓ isolates $2^m$ correctly<br>✓ correctly determines $m$ |