NCEA Level 1 · AS 91946: Making Sense of Maths in Context

Name: _____ Date: _____

This standard is all about reading real information, graphs, tables, formulae and models, then using it to answer questions and back up your thinking. Work through each section in order, and always ask yourself 'what does this number actually mean here?'

Revision summary

- Read carefully: check axis labels, units, scales, headings and the key before you calculate.
- To apply a formula, substitute the given values, keep units consistent, then solve step by step.
- Rate = amount ÷ time (e.g. $/hour, km/h). Cost models often look like: total = fixed charge + rate × quantity.
- Percentage change = (new − old) ÷ old × 100. To increase by r%, multiply by (1 + r/100).
- Reading a graph: interpolate between points; a steeper line means a faster rate of change.
- Justify conclusions with evidence, quote actual numbers from the source, and state any assumptions.
- For Merit, link two or more pieces of information together (e.g. compare two plans, connect a table to a graph).
- For Excellence, generalise (write a rule), prove why a claim is true or false, or evaluate which option is best and defend it.

Key skills

1. A water tank fills at a steady rate. After 3 minutes it holds 240 litres. What is the filling rate in litres per minute?

2. A jacket priced at $80 is discounted by 25%. What is the sale price?

3. A phone plan costs $15 per month plus $0.10 per text. Write a formula for the total cost C (in dollars) for t texts in a month.

4. A line graph of a car's distance shows it travelled 150 km in 2 hours at a steady speed. What was its speed?

Achieved

5. Aroha earns $22.50 per hour at a café in Avondale. One week she works 18 hours. Using the model Pay = rate × hours, calculate her pay for the week.

6. A table shows daily rainfall in Auckland: Mon 4 mm, Tue 0 mm, Wed 12 mm, Thu 8 mm, Fri 6 mm. What was the total rainfall, and the mean daily rainfall over the five days?

7. A recipe for 4 people needs 600 g of flour. Kiri is cooking for 10 people. How much flour does she need?

8. A courier charges a $6 base fee plus $2.50 per kilometre. Use C = 6 + 2.50d to find the cost of a 14 km delivery.

Merit

9. Two gyms in West Auckland offer memberships. FitZone charges $40 joining fee plus $18 per month. PowerHouse charges no joining fee but $22 per month. After how many months do the two gyms cost the same amount, and what is that amount?

10. A shop increases a $250 bike price by 20% for the summer, then in autumn reduces the new price by 20%. A customer says 'the price is back to $250'. Show whether the customer is correct.

11. A graph shows a plant's height: 5 cm at week 0, growing steadily to 25 cm at week 4. Write a formula for the height h after w weeks, then use it to predict the height at week 7. State one reason the prediction may be unreliable.

Excellence

12. A phone company offers Plan A: $30 flat per month for unlimited data. Plan B: $10 per month plus $2 per GB. For what range of data usage is Plan A the cheaper choice? Justify your answer with a general argument.

13. A claim in a local newsletter states: 'Averaging 90 km/h over a 180 km trip means you can drive 100 km/h for the first half of the distance and 80 km/h for the second half.' Determine whether this claim is true, showing your reasoning.

14. A container's rental cost is modelled by C = 50 + 8d for d days. A rival offers a weekly rate of $90 per 7-day week (part weeks rounded up to a full week). Explain, with justification, for which numbers of days each option is cheaper.

Answer key (for parents and tutors)

1. A water tank fills at a steady rate. After 3 minutes it holds 240 litres. What is the filling rate in litres per minute?
   Rate = 240 ÷ 3 = 80 litres per minute.
   Achieved: calculates a rate from given values.

2. A jacket priced at $80 is discounted by 25%. What is the sale price?
   Discount = 25% of $80 = 0.25 × 80 = $20. Sale price = 80 − 20 = $60.
   Achieved: applies a percentage to a context.

3. A phone plan costs $15 per month plus $0.10 per text. Write a formula for the total cost C (in dollars) for t texts in a month.
   C = 15 + 0.10t.
   Achieved: expresses a linear relationship as a formula.

4. A line graph of a car's distance shows it travelled 150 km in 2 hours at a steady speed. What was its speed?
   Speed = distance ÷ time = 150 ÷ 2 = 75 km/h.
   Achieved: reads a graph and computes a rate.

5. Aroha earns $22.50 per hour at a café in Avondale. One week she works 18 hours. Using the model Pay = rate × hours, calculate her pay for the week.
   Pay = 22.50 × 18 = $405.00.
   Achieved: selects and applies a multiplication model.

6. A table shows daily rainfall in Auckland: Mon 4 mm, Tue 0 mm, Wed 12 mm, Thu 8 mm, Fri 6 mm. What was the total rainfall, and the mean daily rainfall over the five days?
   Total = 4 + 0 + 12 + 8 + 6 = 30 mm. Mean = 30 ÷ 5 = 6 mm per day.
   Achieved: reads a table and calculates total and mean.

7. A recipe for 4 people needs 600 g of flour. Kiri is cooking for 10 people. How much flour does she need?
   Flour per person = 600 ÷ 4 = 150 g. For 10 people = 150 × 10 = 1500 g (1.5 kg).
   Achieved: applies proportional reasoning to a context.

8. A courier charges a $6 base fee plus $2.50 per kilometre. Use C = 6 + 2.50d to find the cost of a 14 km delivery.
   C = 6 + 2.50 × 14 = 6 + 35 = $41.00.
   Achieved: substitutes into a given linear model.

9. Two gyms in West Auckland offer memberships. FitZone charges $40 joining fee plus $18 per month. PowerHouse charges no joining fee but $22 per month. After how many months do the two gyms cost the same amount, and what is that amount?
   FitZone: 40 + 18m. PowerHouse: 22m. Set equal: 40 + 18m = 22m, so 40 = 4m, m = 10 months. Cost = 22 × 10 = $220 (check FitZone: 40 + 18×10 = 220). They cost the same at 10 months, $220.
   Merit: links two models and solves to compare them.

10. A shop increases a $250 bike price by 20% for the summer, then in autumn reduces the new price by 20%. A customer says 'the price is back to $250'. Show whether the customer is correct.
    After increase: 250 × 1.20 = $300. After decrease: 300 × 0.80 = $240. The final price is $240, not $250, so the customer is incorrect. A 20% decrease is taken from the larger $300, so it removes more dollars than the 20% increase added.
    Merit: connects successive percentage changes and reasons about the result.

11. A graph shows a plant's height: 5 cm at week 0, growing steadily to 25 cm at week 4. Write a formula for the height h after w weeks, then use it to predict the height at week 7. State one reason the prediction may be unreliable.
    Growth per week = (25 − 5) ÷ 4 = 20 ÷ 4 = 5 cm/week. Formula: h = 5 + 5w. At week 7: h = 5 + 5×7 = 40 cm. It may be unreliable because plants do not usually keep growing at a constant rate forever, growth often slows, so extrapolating beyond the data is risky.
    Merit: connects a graph to a formula and comments on limitations.

12. A phone company offers Plan A: $30 flat per month for unlimited data. Plan B: $10 per month plus $2 per GB. For what range of data usage is Plan A the cheaper choice? Justify your answer with a general argument.
Plan B cost = 10 + 2g where g = GB used. Plan A = 30. Plan A is cheaper when 30 < 10 + 2g, i.e. 20 < 2g, so g > 10. Therefore Plan A is cheaper for any usage above 10 GB per month; at exactly 10 GB they cost the same ($30); below 10 GB Plan B is cheaper. Since Plan A's cost never changes, the more data you use the more Plan A saves you relative to B.
Excellence: solves an inequality and generalises the decision rule.

13. A claim in a local newsletter states: 'Averaging 90 km/h over a 180 km trip means you can drive 100 km/h for the first half of the distance and 80 km/h for the second half.' Determine whether this claim is true, showing your reasoning.
Split into two 90 km halves. First half at 100 km/h takes 90 ÷ 100 = 0.9 hours. Second half at 80 km/h takes 90 ÷ 80 = 1.125 hours. Total time = 2.025 hours for 180 km. Average speed = 180 ÷ 2.025 ≈ 88.9 km/h, not 90 km/h. The claim is false because average speed is total distance ÷ total time, not the mean of the two speeds, the slower half takes longer so it 'weighs' more.
Excellence: disproves a claim with correct reasoning about weighted rates.

14. A container's rental cost is modelled by C = 50 + 8d for d days. A rival offers a weekly rate of $90 per 7-day week (part weeks rounded up to a full week). Explain, with justification, for which numbers of days each option is cheaper.
Rival cost jumps in steps: 1–7 days = $90, 8–14 days = $180, and so on (90 × number of weeks, rounding up). Model C = 50 + 8d. Compare for a first week (d = 1 to 7): C ranges from 50 + 8 = $58 up to 50 + 56 = $106. The model beats $90 when 50 + 8d < 90, i.e. 8d < 40, d < 5, so for 1–4 days the formula is cheaper, and for 5–7 days the $90 week is cheaper (equal-ish near d = 5). For the second week (8–14 days) rival = $180; model = 50 + 8d, which reaches 180 when 8d = 130, d = 16.25, so across days 8–14 the model (max $162 at d=14) stays under $180, the formula is cheaper again. In general the rival's step price is only competitive late in each week; overall the formula is better except roughly days 5–7. A renter should choose the $90 week only for a 5–7 day hire.
Excellence: compares a continuous model with a step function and justifies the optimal choice across ranges.