Practice test 1 - Models and methods

Name: _____ Date: _____

10 questions | 58 marks | 60 minutes

A balanced first paper: solve, construct, compare and interpret linear, piecewise and exponential rules.

A scientific calculator may be used.

1. Work with equations and a delivery formula. [4 marks]

(a) Solve $4x - 7 = 25$. [2 marks]

(b) A delivery over distance d kilometres costs $C = 12 + 3d$ dollars. Find the distance for a 39-dollar bill. [2 marks]

2. A straight line passes through $(0, 8)$ and $(4, 20)$. [6 marks]

(a) Find its gradient. [2 marks]

(b) Write its equation. [2 marks]

(c) Find its x-intercept. [2 marks]

3. A bike-hire company charges 26 dollars for 2 h and 50 dollars for 6 h. Assume a fixed fee plus a constant hourly rate. [7 marks]

(a) Construct the cost rule for h hours. [3 marks]

(b) Find the cost of 3.5 h. [2 marks]

(c) Find the hire time for a 62-dollar bill. [2 marks]

4. A stall receives 15 dollars per item and has total cost $C = 120 + 7n$ dollars. [7 marks]

(a) Find the break-even quantity. [2 marks]

(b) Find profit from 20 items. [2 marks]

(c) Find the smallest whole number of items giving at least 100 dollars profit. [3 marks]

5. Water costs 4 dollars/kL for the first 5 kL and 2.50 dollars/kL above 5 kL. [6 marks]

(a) Write a cost rule for usage $u > 5$. [2 marks]

(b) Find the bill for 8 kL. [2 marks]

(c) Explain whether the two cost branches join at 5 kL. [2 marks]

6. An amount follows $P = 250(1.04)^n$, where n is years. [4 marks]

(a) State the starting amount and annual percentage change. [2 marks]

(b) Find the amount after 3 years, to two decimal places. [2 marks]

7. A quantity follows $V = 180(0.75)^n$. [6 marks]

(a) State its percentage decrease per step. [2 marks]

(b) Find $V(2)$. [2 marks]

(c) Find the first whole step when V is less than 80. [2 marks]

8. Two sequences are recorded at $n = 0,\quad 1,\quad 2,\quad 3$. A: 80,90,100,110. B: 80,88,96.8,106.48. [6 marks]

(a) Choose a linear or exponential rule for each. [2 marks]

(b) Compare their predictions at $n = 4$. [2 marks]

(c) Explain why B can have constant percentage change but changing absolute increases. [2 marks]

9. A data set is $(0, 30), (2, 42), (4, 54)$. A new observation at input 6 is 70. [6 marks]

(a) Fit a straight line to the first three points. [2 marks]

(b) Find the prediction and residual at input 6. [2 marks]

(c) Is the prediction at 6 interpolation relative to the first three points? [2 marks]

10. An initially full tank is described by $V = 90 - 6t$ litres, with t in minutes. [6 marks]

(a) Find when it becomes empty and state the physical time domain. [2 marks]

(b) Evaluate the formula at 18 min and explain its practical meaning. [2 marks]

(c) State one assumption made before the tank empties. [2 marks]