Practice test 3 - Decisions from data

Name: _____ Date: _____

10 questions | 59 marks | 75 minutes

Use calibration, charges, production and investment models to make defensible decisions.

A scientific calculator may be used.

1. Solve and rearrange useful relationships. [4 marks]

(a) Solve $(x-5)/3=4$. [2 marks]

(b) In $W=P(1+r)$, make r the subject. Then find r for W = 230 and P = 200. [2 marks]

2. A sensor converts a raw reading r to a calibrated reading y. Its calibration gives y = −2 at r = 0 and y = 18 at r = 10. [6 marks]

(a) Construct the straight-line calibration. [2 marks]

(b) What raw reading corresponds to calibrated value zero? [2 marks]

(c) Find y when r = 7.5. [2 marks]

3. A workshop sells each item for 24 dollars. Its cost is $C = 500 + 14n$ dollars and capacity is 60 items. [6 marks]

(a) Find break-even and the first profitable whole-number quantity. [2 marks]

(b) How many items would give 250 dollars profit according to the rule? [2 marks]

(c) Can that profit be reached under the stated capacity? State the maximum modelled profit. [2 marks]

4. A group pays 12 dollars per person for its first five people and 8 dollars per additional person. [6 marks]

(a) Write the total-price rule for integer $n > 5$. [2 marks]

(b) Find the price for nine people. [2 marks]

(c) A student proposes $C = 8n$ for every group. Explain the error and its effect for nine people. [2 marks]

5. A vehicle starts at 30000 dollars and retains 85% of its value each year. [7 marks]

(a) Write a depreciation model. [2 marks]

(b) Find its value after four years, to cents. [2 marks]

(c) Find the first whole year in which it is worth less than 10000 dollars. [3 marks]

6. A data set has values 400 at n = 0 and 576 at n = 2. Both a linear and an exponential model are proposed. [6 marks]

(a) Fit a positive-factor exponential rule. [2 marks]

(b) Fit a line through the same observations. [2 marks]

(c) Compare the models at n = 4. [2 marks]

7. Two accounts have models $A = 1000(1.05)^n$ and $B = 1100(1.03)^n$. Assume no fees, deposits or withdrawals. [6 marks]

(a) Compare balances after four years, to cents. [2 marks]

(b) Compare balances after six years. [2 marks]

(c) Explain why the larger starting balance does not settle every later comparison. [2 marks]

8. A linear relationship has observations $(1, 15), (3, 19), (5, 23)$. A later observation at $x = 7$ is 26. [6 marks]

(a) Fit the linear rule. [2 marks]

(b) Find the prediction and residual at $x = 7$. [2 marks]

(c) Does one nonzero residual justify deleting the observation? Explain. [2 marks]

9. A walker has distances d (km) at times t (h): $(0, 0), (2, 6), (5, 6), (7, 14)$. Assume straight segments between these observations. [6 marks]

Distance travelled

t (hours)	0	2	5	7
d (km)	0	6	6	14

(a) Find the speed over the first two hours and explain the segment from t = 2 to 5. [2 marks]

(b) Write the distance rule for $5 \leq t \leq 7$. [2 marks]

(c) Find the average speed for the whole trip. [2 marks]

10. Production is predicted by $N = 500(1.25)^n$ units/day after n weeks. The equipment can make at most 2000 units/day. [6 marks]

(a) Find predictions for weeks 6 and 7. [2 marks]

(b) Find the first whole week at which the prediction exceeds capacity. [2 marks]

(c) Give a practical consequence for using the model. [2 marks]