

EXAM PAPER

General Mathematics Unit 3 & 4 — Examination 1 (Practice 1)

Reading time: 15 minutes (no writing)

Writing time: 90 minutes

Total time: 105 minutes

SECTIONS IN THIS PAPER

- Data analysis — 36 min (calculator allowed)
- Recursion and financial modelling — 18 min (calculator allowed)
- Matrices — 18 min (calculator allowed)
- Networks and decision mathematics — 18 min (calculator allowed)

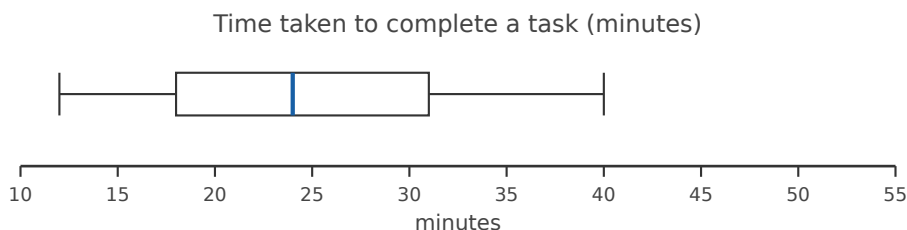
INSTRUCTIONS

You are not permitted to write during reading time — you may only read the paper and plan your approach. Answer every question you can. Write your working in the space provided for long-answer questions. Marking guidance and full explanations are provided in the separate answer key.

Data analysis

36 minutes • Calculator allowed

1. The box plot below displays the time taken, in minutes, by a group of workers to complete a task. Any value greater than which of the following would be displayed as an outlier?



A. 37.5

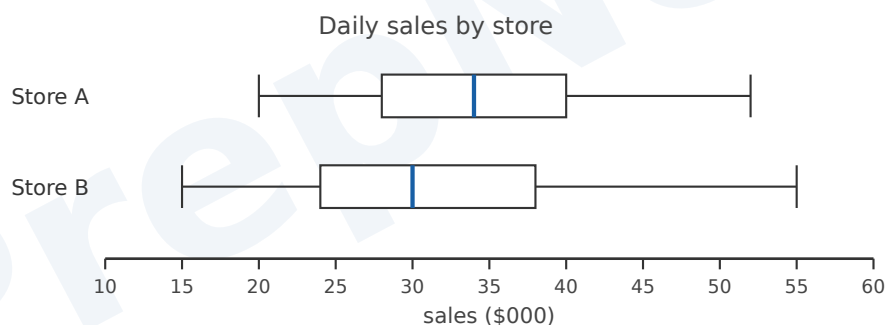
B. 43.5

C. 50.5

D. 44

E. 62

2. The parallel box plots below display daily sales, in thousands of dollars, for two stores. The interquartile range for Store B is



A. 14

B. 12

C. 23

D. 40

E. 2

3. In a study of housing, the variable postcode is best described as

A. numerical and discrete

B. numerical and continuous

C. categorical and ordinal

D. neither numerical nor categorical

E. categorical and nominal

4. The weights of a large group of adults are approximately normally distributed with a mean of 70 kg and a standard deviation of 4 kg. The percentage of these adults with a weight between 62 kg and 78 kg is closest to

A. 34%

B. 95%

C. 68%

D. 99.7%

E. 47.5%

5. A test has a mean of 72 and a standard deviation of 8. The standardised score (z-score) of a student who scored 60 is

A. -12

B. 1.5

C. -0.67

D. -1.5

E. 1

6. On a test with a mean of 64 and a standard deviation of 12, a student's standardised score was 1.25. The student's actual mark was

A. 76

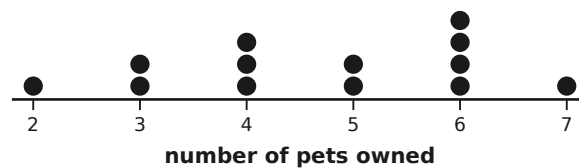
B. 79

C. 80

D. 78

E. 65.25

7. The dot plot below shows the number of pets owned by each of 13 households. The median number of pets owned is



A. 4

B. 4.5

C. 5

D. 6

E. 7

8. The two-way frequency table below shows the responses of 140 people to a survey question. The percentage of females who answered Yes is closest to

Response by gender

Response	Male	Female
Yes	42	35
No	18	45

A. 43.8%

B. 25.0%

C. 45.5%

D. 70.0%

E. 24.8%

9. The correlation coefficient between two numerical variables is $r = -0.68$. The percentage of the variation in one variable that is explained by the variation in the other is closest to

A. 68%

B. 82%

C. 23%

D. 54%

E. 46%

10. A least squares line fitted to data on delivery cost and distance has the equation $\text{cost} = 12.5 + 3.2 \times \text{distance}$, where cost is in dollars and distance is in kilometres. The slope of this line tells us that, on average,

A. the cost of a delivery is \$3.20

B. the cost of a delivery is \$12.50

C. each extra kilometre adds \$3.20 to the cost

D. each extra kilometre adds \$12.50 to the cost

E. each extra dollar of cost adds 3.2 kilometres

11. A least squares line has the equation $y = 8.4 + 1.6x$. When $x = 12$, the actual value of y was 25.1. The residual for this data point is

A. -2.5

B. 2.5

C. 27.6

D. 25.1

E. -0.5

12. A least squares line is fitted to a set of data, and the residual plot shows a clear curved pattern. This indicates that

A. the data contains an outlier

B. the correlation coefficient must be negative

C. the association is not linear, so a linear model is not appropriate

D. the least squares line has been calculated incorrectly

E. the two variables are not associated

13. A scatterplot of y against x shows an association that increases steadily but flattens out as x increases. Which transformation is most likely to linearise this association?

A. a y^2 transformation

B. a $\log_{10}(x)$ transformation

C. an x^2 transformation

D. a $1/y$ transformation

E. no transformation will linearise it

14. The table below shows visitor numbers, in hundreds, over seven months. The three-point moving average for month 4 is

Monthly visitor numbers (hundreds)

Month	1	2	3	4	5	6	7
Visitors	24	28	26	30	34	32	38

A. 26

B. 28

C. 29.3

D. 30

E. 32

15. The seasonal index for winter sales at a ski hire shop is 1.25. In one winter, actual sales were \$8000. The deseasonalised sales figure for that winter is

A. \$9600

B. \$10 000

C. \$8000

D. \$6250

E. \$6400

16. The seasonal indices for summer, autumn and winter are 1.15, 0.92 and 1.08 respectively. The seasonal index for spring is

A. 0.85

B. 0.95

C. 1.00

D. 0.75

E. 1.15

PrepNest

Recursion and financial modelling

18 minutes • Calculator allowed

17. A sequence is generated by the recurrence relation $A_0 = 12$, $A_{n+1} = 3A_n - 8$. The value of A_2 is

A. 28

B. 44

C. 100

D. 76

E. 220

18. A machine is purchased for \$24 000 and depreciated using the flat rate method at 15% of the purchase price per annum. The value of the machine after four years is

A. \$8400

B. \$9600

C. \$12 528

D. \$14 400

E. \$10 200

19. A car purchased for \$32 000 loses 12% of its value each year. A recurrence relation that models the value V_n , in dollars, of the car after n years is

A. $V_0 = 32\,000$, $V_{n+1} = V_n - 0.12$

B. $V_0 = 32\,000$, $V_{n+1} = 1.12V_n$

C. $V_0 = 32\,000$, $V_{n+1} = V_n - 3840$

D. $V_0 = 32\,000$, $V_{n+1} = 0.12V_n$

E. $V_0 = 32\,000$, $V_{n+1} = 0.88V_n$

20. A delivery van is purchased for \$45 000 and depreciated by the unit cost method at a rate of \$0.25 per kilometre travelled. After the van has travelled 60 000 km, its value is

A. \$28 000

B. \$15 000

C. \$33 750

D. \$30 000

E. \$44 750

21. An amount of \$6000 is invested at 4.8% per annum, compounding monthly. The value of the investment after three years is closest to

A. \$6927.31

B. \$6864.00

C. \$6904.20

D. \$7013.80

E. \$6900.00

22. A reducing balance loan is modelled by the recurrence relation $V_0 = 180\,000$, $V_{n+1} = 1.0035V_n - 1250$, where V_n is the balance in dollars after n months. The annual interest rate for this loan is

A. 0.35%

B. 3.5%

C. 4.28%

D. 4.2%

E. 42%

23. A loan of \$250 000 is charged interest at 5.4% per annum, compounding monthly, with monthly repayments of \$1600. The amount by which the first repayment reduces the principal is

A. \$350

B. \$475

C. \$1125

D. \$1600

E. \$2725

24. A perpetuity pays \$450 per month indefinitely from an investment of \$120 000. The annual interest rate for this perpetuity is

A. 0.375%

B. 4.0%

C. 5.4%

D. 3.75%

E. 4.5%

Matrices

18 minutes • Calculator allowed

25. For matrix M below, the element m_{23} is

$$M = \begin{bmatrix} 4 & 7 & 2 \\ 9 & 3 & 8 \end{bmatrix}$$

A. 2

B. 3

C. 8

D. 7

E. 9

26. Matrix A has order 3×2 and matrix B has order 2×4 . The order of the product matrix AB isA. 3×4 B. 2×2 C. 4×3 D. 3×2

E. the product AB is not defined

27. Let A be the matrix below and let B be the matrix with first row 5, 1 and second row 2, 6. The element in row 1, column 2 of the product AB is

$$A = \begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix}$$

A. 11

B. 13

C. 16

D. 25

E. 20

28. The determinant of matrix P below is

$$P = \begin{bmatrix} 6 & 4 \\ 2 & 3 \end{bmatrix}$$

A. 8

B. 10

C. 18

D. 26

E. -10

29. A population of 1000 is split evenly between states A and B, and moves between them each week according to the transition matrix T below. The number in state A after one week is

$$T = \begin{matrix} & \begin{matrix} A & B \end{matrix} \\ \begin{matrix} A \\ B \end{matrix} & \begin{bmatrix} 0.8 & 0.3 \\ 0.2 & 0.7 \end{bmatrix} \end{matrix}$$

A. 400

B. 450

C. 500

D. 550

E. 650

30. A population of 900 moves between states A and B each year according to the transition matrix T below. In the long run, the number in state A is closest to

$$T = \begin{matrix} & \begin{matrix} A & B \end{matrix} \\ \begin{matrix} A \\ B \end{matrix} & \begin{bmatrix} 0.9 & 0.2 \\ 0.1 & 0.8 \end{bmatrix} \end{matrix}$$

A. 450

B. 540

C. 600

D. 675

E. 300

31. A permutation matrix has exactly one 1 in each row and each column, with every other element 0. Multiplying a column matrix by a permutation matrix will

A. reorder the elements of the column matrix

B. add the elements of the column matrix together

C. leave the column matrix unchanged

D. replace every element with its reciprocal

E. change the order of the column matrix

32. Matrix X satisfies $3X + C = D$, where C has first row 2, 5 and second row 1, 4, and D has first row 11, 20 and second row 7, 16. The element in row 2, column 1 of X is

A. 3

B. 2

C. 4

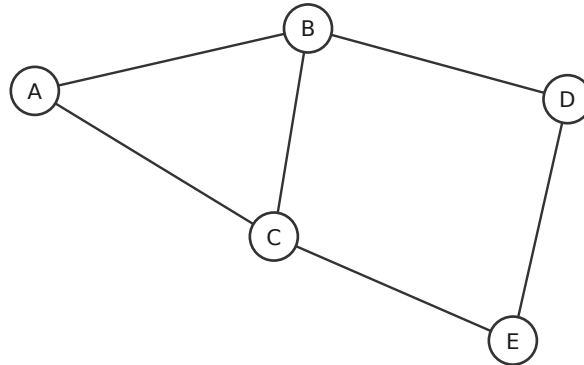
D. 5

E. 6

Networks and decision mathematics

18 minutes • Calculator allowed

33. For the graph below, the sum of the degrees of the vertices is



A. 10

B. 11

C. 12

D. 6

E. 24

34. A connected planar graph has 6 vertices and 9 edges. Using Euler's formula, the number of faces is

A. 3

B. 4

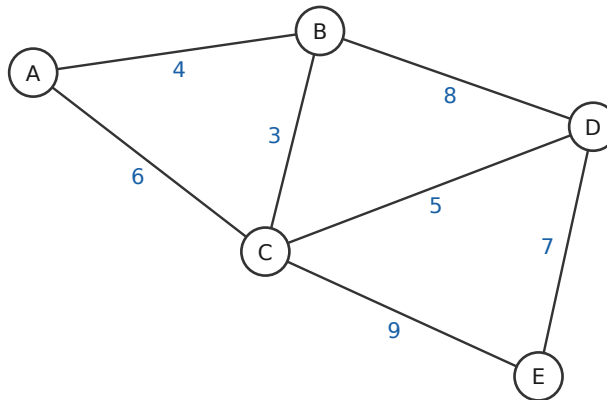
C. 6

D. 17

E. 5

35. For the weighted graph below, the total weight of the minimum spanning tree is

Cable cost between sites (\$000)



A. 19

B. 18

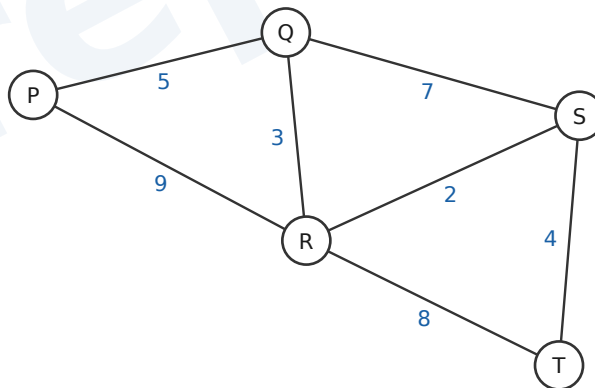
C. 20

D. 22

E. 24

36. For the weighted graph below, the length of the shortest path from P to T is

Travel time between towns (minutes)



A. 13

B. 15

C. 16

D. 14

E. 17

37. Each of three workers is assigned a different task. The table below shows the time, in minutes, each worker takes on each task. The minimum total time to complete all three tasks is

Time taken, in minutes

Worker	Task 1	Task 2	Task 3
Wendy	9	7	8
Xavier	6	8	9
Yuki	7	6	5

A. 17

B. 18

C. 19

D. 20

E. 21

38. The table below shows the activities in a project, their durations and their immediate predecessors. The minimum time to complete the project is

Project activities

Activity	Duration (days)	Immediate predecessors
A	4	-
B	3	-
C	5	A
D	2	A
E	6	B
F	3	C, D
G	4	E, F

A. 13

B. 14

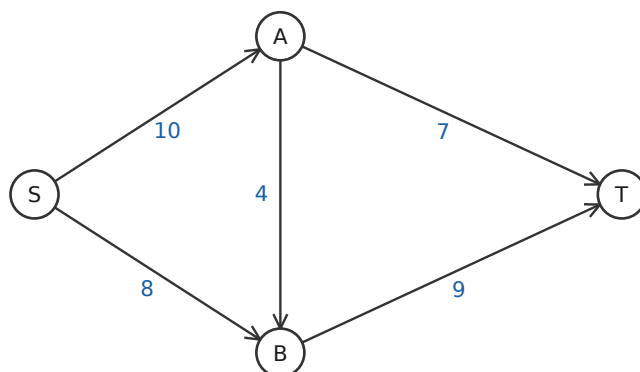
C. 15

D. 18

E. 16

39. The directed network below shows the maximum flow along each path, in units per minute. The maximum flow from S to T is

Maximum flow per minute



A. 15

B. 17

C. 16

D. 18

E. 19

40. A connected graph with 7 vertices is a tree. The number of edges in this graph is

A. 7

B. 8

C. 12

D. 6

E. 21