Financial mathematics - Applications

16 questions | 49 marks | 60 minutes

A camp budget, transport choices and constrained financial models.

Equivalent correct methods earn the corresponding marks.

1. An 80-dollar hire charge increases by 15%. Find the new charge. [2 marks]

$80(1.15) = 92$.

Answer: AUD 92.00

2. Find simple interest on 2,000 dollars at 3% per year for 6 months. [2 marks]

$t = 0.5$.

$I = 2000(0.03)(0.5) = 30$.

Answer: AUD 30.00

3. An account starts at 1,000 dollars and has balances 1,050, 1,100 and 1,150 dollars after years 1, 2 and 3. Explain its simple-interest rate. [3 marks]

Annual interest is a constant 50 dollars.

$50/1000 = 0.05 = 5\%$.

Answer: 5% per year

4. A camp charges 20 dollars per student. Costs are 130 dollars plus 7 dollars per student. Find the break-even count. [3 marks]

$20n = 130 + 7n$.

$13n = 130$, so $n = 10$.

Answer: 10 students

5. A camp charges 20 dollars per student and costs 130 dollars fixed plus 7 dollars per student. Find the balance if 8 students attend. [3 marks]

Income $= 160$.

Cost $= 130 + 56 = 186$.

Balance $= 160 - 186 = -26$.

Answer: AUD 26.00 shortfall

6. A camp charges 20 dollars per student and costs 130 dollars fixed plus 7 dollars per student. Find the balance if 12 students attend. [3 marks]

Income $= 240$.

Cost $= 130 + 84 = 214$.

Balance $= 26$.

Answer: AUD 26.00 surplus

7. A camp charges 20 dollars per student. Its original costs are 130 dollars fixed plus 7 dollars per student. An extra 26-dollar fixed fee is added. Find the new break-even count. [3 marks]

New fixed cost $= 156$.

$20n = 156 + 7n$, so $13n = 156$ and $n = 12$.

Answer: 12 students

8. A camp charges 20 dollars per student and now costs 156 dollars fixed plus 7 dollars per student. Capacity is 11 students. Can the camp break even? Explain. [4 marks]

Maximum income $= 11(20) = 220$.

Cost $= 156 + 11(7) = 233$.

The needed count 12 exceeds capacity.

Answer: No; even at 11 students it has an AUD 13.00 shortfall.

9. Transport A costs $60 + 3n$ dollars and B costs $20 + 5n$ dollars. Find their equal-cost group size and price. [3 marks]

$60 + 3n = 20 + 5n$ gives $40 = 2n$.

At 20, both cost 120.

Answer: $n = 20$; AUD 120.00

10. Transport A costs $60 + 3n$ dollars and B costs $20 + 5n$ dollars for n students. Compare costs for 15 students. [2 marks]

$60 + 3(15) = 105$.

$20 + 5(15) = 95$.

Answer: A: AUD 105.00; B: AUD 95.00. B is AUD 10.00 cheaper.

11. Transport A costs $60 + 3n$ dollars and B costs $20 + 5n$ dollars for n students. Compare costs for 30 students. [2 marks]

$60 + 3(30) = 150$.

$20 + 5(30) = 170$.

Answer: A: AUD 150.00; B: AUD 170.00. A is AUD 20.00 cheaper.

12. Revenue is $R = n(22 - n)$ dollars, and venue capacity is 11. [4 marks]

(a) Find both whole-number counts giving revenue 120 dollars. [3 marks]

$n^2 - 22n + 120 = (n - 10)(n - 12) = 0$.

Answer: $n = 10, 12$

(b) Which count is feasible? [1 mark]

Twelve exceeds capacity, while ten does not.

Answer: $n = 10$

13. Profit models are $P_A = 4n - 20$ and $P_B = -n^2 + 14n - 20$ dollars. [5 marks]

(a) Find their equal-profit counts. [3 marks]

$4n - 20 = -n^2 + 14n - 20$ gives $n(n - 10) = 0$.

Answer: $n = 0, 10$

(b) Compare profits at n=6. [2 marks]

$P_A = 24 - 20 = 4$.

$P_B = -36 + 84 - 20 = 28$.

Answer: A: AUD 4.00; B: AUD 28.00, so B is AUD 24.00 higher.

14. A 500-dollar budget includes transport 200, materials 120, food 80 and reserve 50 dollars. Food rises by 20%. Find the remaining balance. [3 marks]

New food cost $= 80(1.20) = 96$.

Total planned use $= 200 + 120 + 96 + 50 = 466$.

$500 - 466 = 34$.

Answer: AUD 34.00

15. A stall charges 10 dollars per item; costs are 100 dollars fixed plus 2 dollars per item. Compare surpluses for 20 and 15 sales. [4 marks]

At 20: $200 - (100 + 40) = 60$.

At 15: $150 - (100 + 30) = 20$.

The fixed cost remains 100.

Answer: 20 sales: AUD 60.00; 15 sales: AUD 20.00. Five fewer sales reduce surplus by AUD 40.00.

16. A printing model is $C = 0.015n^2 + 2n + 25$ dollars, valid only for whole counts $0 \le n \le 40$. [3 marks]

(a) Find the modelled cost of 10 copies. [2 marks]

$C(10) = 0.015(100) + 20 + 25 = 46.5$.

Answer: AUD 46.50

(b) Does the rule alone justify a quote for 500 copies? [1 mark]

Five hundred is outside the stated domain; another pricing rule may apply.

Answer: No.