Year 11 Mathematics Advanced

Topic: Working with Functions (6 of 12)
Review Questions: Constructing and Using Functions
Term 3, 2026

How to use this review set

These are real past-paper questions, grouped by question pattern. The grey label on each question shows where it is from and its marks.

- The questions are grouped by the pattern that keeps coming up in exams, a few of each in a row, running from the plainer patterns into the harder ones near the end. Work through them and you will meet every type an exam can throw at you.
- This set **is your diagnostic**. Working through it shows you exactly which patterns are solid and which need work. Attempt every question properly in your own book, and go back to your notes to help you work through tough questions if needed.
- Every question you get wrong, need help with or struggle with goes in your **Mistakes Log**, which you should be working on daily to get you exam-ready.

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Building and using linear models

1. Write a linear cost/revenue function from a worded description

Q1 Sydney Tech 2024 Trial Q13(a) · **1 mark**

Jamie owns a company producing and selling pizzas. The income function is $y = 20x$, where x is the number of pizzas sold. The cost of producing these pizzas includes a set-up cost of \$50 and additional costs of \$10 per pizza. Write the cost function in the form $y = mx + c$.

Q2 Hornsby Girls 2024 Trial Q11(a) · **1 mark**

The incoming revenue for a catering company, R, is based on a \$1 000 hiring fee plus \$20 per person, where x is the number of guests. Write the equation for R in terms of x.

Q3 Normanhurst Boys 2023 Trial Q11(a) · **1 mark**

Sam and Jammy are planning a fund-raising dance. They can hire a hall for \$400 and a band for \$300. Refreshments will cost them \$12 per person. Write a formula for the cost (\$$C$) of running the dance for x people.

Q4 Killara 2024 Trial Q12(a) · **2 marks**

The population of a town in NSW has shown a linear decline in the years 2011 to 2019. In 2011 the population was 34 300 people. In 2019 it was 27 740 people. Write a linear equation expressing the population of the town, P, as a function of t, the number of years since 2011.

Q5 North Sydney Girls 2021 Prelim Q1(c) · **3 marks**

At my local printing shop, it costs me \$39 for printing 600 sheets and \$51 for printing 800 sheets.

(i) Assuming that the relationship is linear, find a formula for the charge \$$C$ for printing n sheets.

(ii) What is the charge for printing 1025 sheets?

2. Use a given model: evaluate at a value and solve for the input

Q6 Riverview 2022 Trial Q11(a) · 1 mark

A rainwater tank, initially full, is drained so that at time t minutes the volume of water V in litres is given by

$$V = 500\left(1 - \frac{t}{60}\right)^2, \qquad 0 \leq t \leq 60.$$

How much water was initially in the tank?

Q7 Sydney Girls 2020 Trial Q16(a) · 1 mark

The population P, in thousands, of a small city is given by

$$P(t) = \frac{500t}{2t^2 + 9},$$

where t is the time in years. Find the population after 10 months.

Q8 Moriah 2021 Prelim Q18(a) · 1 mark

Sophie is breeding mice for a laboratory. The number of mice M she has after t months is given by

$$M = 12 + 5t + 4t^2.$$

How many mice does she have initially?

Q9 St George Girls 2022 Prelim Q34(a) · 1 mark

The number of people in a stadium is approximated by

$$N = 416t^2 - 13t^3 + 88\,400,$$

where N is the number of people and t is the time in hours after 11 a.m. How many people are in the stadium at 2 p.m.?

Q10 Sydney Tech 2020 Trial Q34(b) · 1 mark

A large tank of liquid contains a toxic chemical which is being drained. The amount of chemical L litres in the tank after t minutes is given by

$$L = 110(20 - t)^2.$$

How long will it take for the tank to be completely empty?

Q11 Moriah 2021 Prelim Q18(d) · **2 marks**

The number of mice M after t months is given by

$$M = 12 + 5t + 4t^2.$$

Sophie's parents allow her to keep a maximum of 100 mice. After how many months will she reach this number? (Give your answer to 2 decimal places.)

Q12 Moriah 2021 Trial Q12 · **2 marks**

A crystal growth furnace is controlled by adjusting the input power. The relationship is

$$T = 0.1w^2 + 2.155w + 20,$$

where T is the temperature in degrees Celsius and w is the (positive) input power in watts. How much power is needed to maintain the temperature at 200°C? (Give your answer to 2 decimal places.)

Q13 Killara 2020 Trial Q19(a) · **3 marks**

A swimming pool is to be emptied for maintenance. The quantity of water Q litres remaining in the pool t minutes after it starts to drain is given by

$$Q(t) = 2000(25 - t)^2, \qquad t \geq 0.$$

How long will it take to remove half of the water from the pool? (Give your answer to the nearest minute.)

3. Find the break-even point (algebraically and from a graph)

Q14 Baulkham Hills 2024 Trial Q1 · **1 mark**

A small business makes and sells bird houses. Technology was used to draw straight-line graphs to represent the cost of making bird houses (C) and the revenue from selling bird houses (R). The horizontal axis displays the number of bird houses and the vertical axis displays the cost/revenue in dollars.

Diagram to be inserted:
`adv-working-with-functions-d6-q14.png`

How many bird houses need to be sold to break even?

(A) 10

(B) 20

(C) 30

(D) 40

Q15 Baulkham Hills 2023 Trial Q1 · **1 mark**

Stephanie bakes cupcakes to sell. The cost C, in dollars, for x cupcakes to be produced is given by the equation $C = 200 + 2x$. Each cupcake is then sold for \$4. How many cupcakes does Stephanie need to make to break even?

(A) 0

(B) 25

(C) 100

(D) 200

Q16 Ascham 2020 Trial Q16 · **4 marks**

Ali decides to turn her crochet hobby into a small not-for-profit business. She spends \$60 on equipment and estimates that it costs her \$16 to manufacture each crochet doll. She plans to sell each doll for \$20.

(a) Write equations for the cost C, and income I, for the sale of x items.

(b) Solve the equations simultaneously to determine the number of dolls Ali needs to sell to break even.

Q17 Presbyterian Ladies 2023 Prelim Q21 · **3 marks**

Jenny decides to go into the donut business. She buys some start-up equipment to the value of \$140. She has worked out that it will cost her \$1.50 to make each donut, and she intends to sell them for \$5.00 each.

(a) Graph her costs and revenue on the grid below.

(b) Use your graphs to find the number of donuts Jenny needs to sell to break even.

Q18 North Sydney Girls 2022 Prelim Q16 · **5 marks**

A small manufacturer makes and sells power generator units with the following finances: fixed costs of \$600 per week; each unit costs \$15 to produce; the selling price of each unit is \$30.

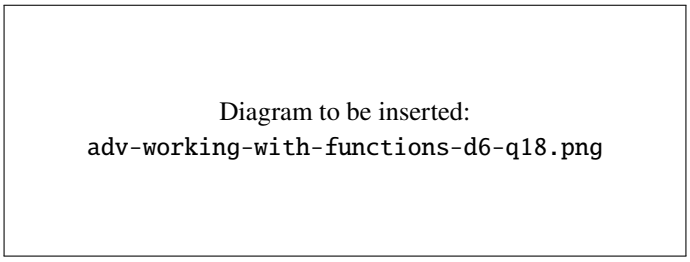
(a) Write a linear equation to represent the Cost function C for the number of power generator units u produced.

(b) Find the number of units to be sold for the manufacturer to break even.

(c) The manufacturer sells 24 units in a particular week. Determine the amount of profit or loss incurred during this week.

(d) The graph of the Revenue function R is provided. Draw the graph of the Cost function on the same axes, clearly labelling the break-even point.

(e) The manufacturer needs to increase their fixed costs to \$900. Write a new equation for the Revenue function so that the break-even point remains at the same number of units sold.



Q19 North Sydney Girls 2023 Trial Q5 · **1 mark**

A bus company runs tours around North Sydney. Each tour costs the company \$273 in fuel plus \$48 per person in other costs. Tourists are charged \$65 per person for the tour. What is the minimum number of tourists the bus company needs to recruit for the tour to break even?

(A) 3 tourists

(B) 5 tourists

(C) 16 tourists

(D) 17 tourists

Q20 Pymble 2022 Prelim Q20 · **3 marks**

Consider the *We are Jeans* store. It costs the business \$29 to make a pair of jeans (this includes materials and labour). The fixed costs come to \$1000. The store sells the jeans for \$49 per pair. How many pairs of jeans do they have to sell to start making a profit on them?

4. Profit/loss at a quantity, and quantity for a target profit

Q21 Baulkham Hills 2025 Trial Q13 · **3 marks**

Eric is organising a gala dinner. The function centre will charge him \$2 000 to hire the room and he needs to pay a catering company \$80 per person for food.

(a) Write an equation for the cost C of hosting the event for n people.

The graph below shows the planned income and costs if Eric charges \$120 per ticket.

Diagram to be inserted:
`adv-working-with-functions-d6-q21.png`

(b) Estimate the number of people required to break even.

(c) What is the profit if 75 people attend the dinner?

Q22 Normanhurst Boys 2023 Trial Q11(c) · **1 mark**

Sam and Jammy are planning a fund-raising dance. They can hire a hall for \$400 and a band for \$300, and refreshments cost \$12 per person, so the cost of running the dance for x people is $C = 12x + 700$. Tickets are sold at \$20 each, giving an income of $20x$ dollars. How much profit will be made if 150 people attend the dance?

Q23 Hornsby Girls 2024 Trial Q11(d) · **1 mark**

A catering company has revenue $R = 1000 + 20x$ (a \$1 000 hiring fee plus \$20 per guest) and cost $C = 1200 + 10x$, where x is the number of guests. Find the value of x when a profit of \$500 is made.

Q24 Moriah 2021 Trial Q15 · **5 marks**

Nicky has opened a business to customise skateboards. The cost of production is given by $C = 20x + 600$ dollars and the income earned is given by $I = 50x$, where x is the number of skateboards produced.

(a) If the production cost is \$800, how many skateboards have been manufactured?

(b) Graph both equations on the axes provided.

(c) What is the minimum number of skateboards that Nicky must sell to make a profit?

Q25 Normanhurst Boys 2023 Trial Q11(d) · **2 marks**

Sam and Jammy run a fund-raising dance whose cost for x people is $C = 12x + 700$ dollars (hall \$400, band \$300, refreshments \$12 per person). They plan to sell 200 tickets and want to make a profit of \$1500. What should be the price of a ticket, assuming all 200 tickets are sold?

Q26 Abbotsleigh 2020 Trial Q12(c) · **4 marks**

Terry is starting a small business making face masks. Technology was used to draw straight-line graphs to represent the cost C of Terry making face masks and the revenue R from him selling them. The x-axis displays the number of face masks and the y-axis displays the cost/revenue in dollars.

Diagram to be inserted:
`adv-working-with-functions-d6-q26.png`

(a) How many face masks must Terry sell to break even?

(b) By first forming equations for the cost C and the revenue R, determine how many face masks need to be sold to earn Terry a profit of \$1500.

Graphs, systems and optimisation

5. Graph or sketch a model, then read a value off it

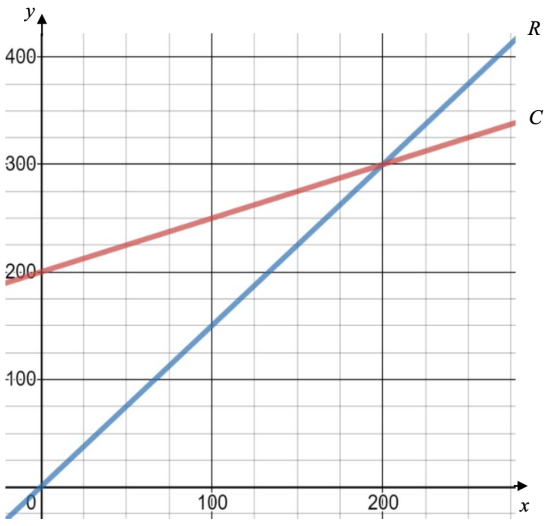
Q27 Hornsby Girls 2024 Trial Q11(b) · **1 mark**

A catering company's cost, measured in dollars, is modelled by $C = 1200 + 10x$, where x is the number of guests. On a set of axes (guests x on the horizontal axis, dollars on the vertical axis), draw the graph of this cost model and label it C.

Diagram to be inserted:
`adv-working-with-functions-d6-q27.png`

Q28 North Sydney Girls 2020 Trial Q14(a) · **2 marks**

A brick company has an annual production capacity of 100 000 standard bricks. The cost of production is fixed at \$60 000 plus \$0.60 per brick. Find the equation for the cost C (in dollars) of producing x bricks, and plot this graph on a set of axes for $0 \leq x \leq 100\,000$.



Q29 Newington 2024 Trial Q12 · **4 marks**

The volume V of a puddle, measured in millilitres (mL), is proportional to the square of its length L, measured in centimetres (cm). When the puddle is 8 cm long its volume is 29.44 mL.

(a) Find the equation relating V and L.

(b) By first completing the table of values below, graph the relationship between the length of the puddle and the volume of the puddle from $L = 10$ cm to $L = 50$ cm.

L	10	20	30	40	50
V					

Q30 Glenwood 2021 Trial Q14 · **5 marks**

From the top of a tower, which is 60 metres high, Isaac throws a stone upward and allows it to fall under gravity. The height of the stone is modelled by the equation $h = 20t - 5t^2 + 60$, where h is the height (in metres) of the stone above ground level and t is the time in seconds since the stone was thrown.

(a) On the grid below, draw the graph of this model and label it as Stone.

(b) At the same time as the stone is thrown, Jay releases a toy glider from the top of the tower. The glider drifts down, losing height at a constant rate of 5 metres per second. Draw the graph modelling the height of the glider on the same grid and determine the equation which describes the model. Label the graph Glider.

(c) Determine the height of the glider when the stone reaches the ground.

Q31 Roseville 2023 Trial Q11(b) · **2 marks**

Chloe builds a rectangular chicken enclosure against an existing wall using 16 metres of fencing, with dimensions x and y satisfying $2x + y = 16$. The area is $A = 16x - 2x^2$, whose graph is shown below.

Diagram to be inserted:
`adv-working-with-functions-d6-q31.png`

Use the graph to determine the value(s) of x that would give the enclosure an area of 24 m^2, and give the dimensions of the enclosure in each case.

6. Simultaneous linear models: intersection, meeting and comparison problems

Q32 Sydney Boys 2025 Trial Q11(b) · **2 marks**

Jayme has \$100 and saves \$25 each week, so his savings after t weeks are modelled by $S = 100 + 25t$, where S is the number of dollars saved and t is the time in weeks. Jorge, Jayme's brother, starts saving 8 weeks after Jayme. He begins with no money and saves \$40 each week. By drawing a line on the same grid, or otherwise, find the value of t when the two brothers have the same amount of money.

Q33 St George Girls 2022 Trial Q16(b) · **2 marks**

Chris and Ann take part in a charity bicycle ride between Canberra and Liverpool. Chris leaves Canberra and rides toward Liverpool, a distance of 250 km, at 20 km/h; his distance from Liverpool is modelled by $C = 250 - 20t$, where t is the time in hours he has been riding. Ann rides in the opposite direction, leaving from Berrima (90 km from Liverpool) at the same time as Chris and riding at 12 km/h towards Canberra. By drawing a line on the grid, or otherwise, find the value of t when Chris and Ann pass each other.

Q34 Penrith 2024 Trial Q13(b) · **2 marks**

Owais has two balloons, Balloon A and Balloon B. Balloon A starts full with 800 cm^3 of air and deflates at a constant rate, becoming empty after 40 seconds; its volume is modelled by $V_A = 800 - 20t$, where t is the time in seconds. Balloon B starts empty. After 10 seconds of Balloon A deflating, Owais' mum begins to inflate Balloon B at a rate of 40 cm^3/s. Find the value of t when the two balloons contain the same amount of air.

Diagram to be inserted:
`adv-working-with-functions-d6-q34.png`

Q35 St George Girls 2022 Trial Q16(d) · **2 marks**

Chris and Ann take part in a charity bicycle ride. Chris rides from Canberra toward Liverpool at 20 km/h and Ann rides from Berrima toward Canberra at 12 km/h, both starting at the same time, where t is the time in hours since they started. Find the value of t when the two riders have ridden a combined total of 264 km.

Q36 Danebank 2021 Trial Q13(a) · **3 marks**

A tennis arena has a maximum capacity of 15 000 spectators. The number of spectators, N, and the ticket price in dollars, P, are modelled by the linear relationship $N = m \times P + c$, where m and c are constants. The arena's records show that when the price of a ticket is \$50 the attendance averages 12 500 spectators, and when the price is \$35 the attendance averages 14 000 spectators. By developing and solving a pair of simultaneous equations, show that the number of spectators as a function of ticket price can be expressed as $N = -100P + 17\,500$.

7. Construct a quadratic/rational function from a geometric setup ("show that")

Q37 Roseville 2023 Trial Q11(a) · **1 mark**

Chloe plans to build a rectangular enclosure for her new chickens against an existing wall, using 16 metres of wire fencing. She calls the dimensions of the enclosure x and y (the side along the wall does not need fencing). She reasons that $2x + y = 16$. Write y in terms of x and hence show that the area of the enclosure can be written as

$$A = 16x - 2x^2.$$

Diagram to be inserted:
`adv-working-with-functions-d6-q37.png`

Q38 James Ruse 2024 Trial Q27 · **5 marks**

A long rectangular sheet of metal 28 cm wide is to be made into a gutter by turning up sides of equal height x cm, perpendicular to the base, as shown below.

Diagram to be inserted:
`adv-working-with-functions-d6-q38.png`

(a) Show that the formula for the cross-sectional area, A, of the gutter is $A = 28x - 2x^2$.

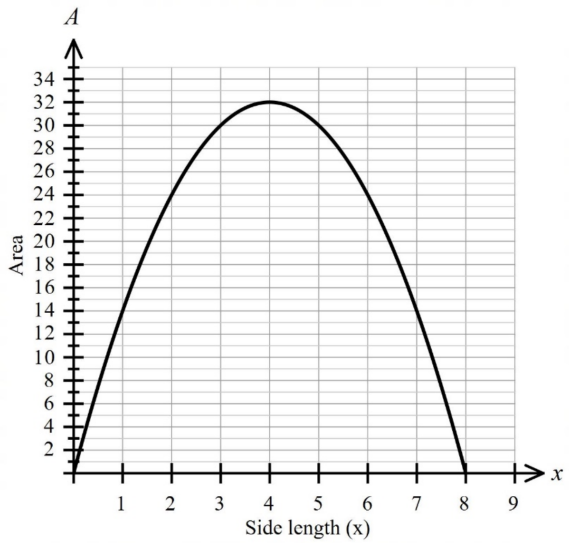
(b) Explain why this formula is only valid for $x \in (0, 14)$.

(c) Find the maximum value of A.

Q39 2023 HSC Q24(a) · **1 mark**

A gardener wants to build a rectangular garden of area 50 m^2 against an existing wall. A concrete path of width 1 metre is to be built around the other three sides of the garden. Let x and y be the dimensions, in metres, of the outer rectangle (path included) as shown in the diagram. Show that

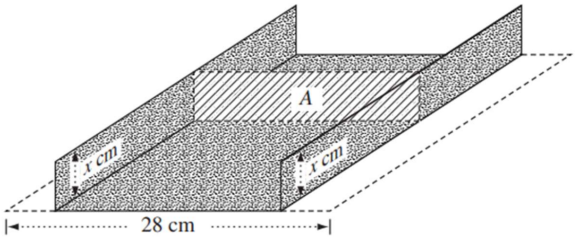
$$y = \frac{50}{x - 2} + 1.$$



Q40 North Sydney Girls 2024 Trial Q28(a) · **1 mark**

A new logo is to be made by inscribing a rectangle inside a quadrant of radius 3 cm, as shown. The length and width of the rectangle are x and y cm respectively, and $x^2 + y^2 = 9$. Show that the area of the rectangle is given by

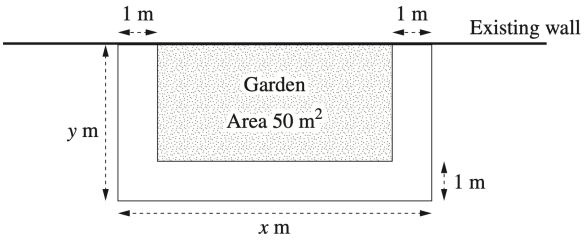
$$A = x\sqrt{9 - x^2}.$$



Q41 2020 HSC Q25(a) · **3 marks**

A landscape gardener wants to build a garden bed in the shape of a rectangle attached to a quarter-circle. Let x and y be the dimensions of the rectangle in metres, as shown in the diagram, and let the quarter-circle have radius x. The garden bed is required to have an area of 36 m^2 and to have a perimeter which is as small as possible. Let P metres be the perimeter of the garden bed. Show that

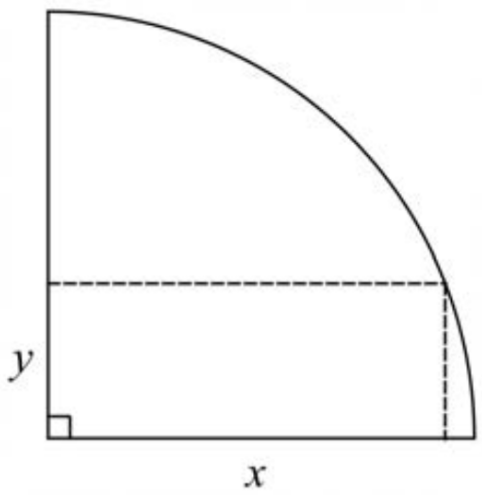
$$P = 2x + \frac{72}{x}.$$



Q42 Baulkham Hills 2024 Trial Q30(a) · **2 marks**

The figure shows a coffee jar with a lid sitting directly on top. The jar is a right circular cylinder of radius x cm and height h cm. It is fitted with a lid of height 2 cm, which fits tightly on top of the jar (so the lid is a band of the same radius x). The jar and its lid are made of thin sheet metal with no wastage, and the total metal used is 190 cm^2; that is, $2x(h+2)+2x^2=190$. Show that the volume of the jar, V cm^3, is given by

$$V=\pi\left(95x-2x^2-x^3\right).$$



Q43 Penrith 2022 Prelim Q30 · **3 marks**

A cyclist goes up a long slope at a constant speed of 15 km/h. He turns around and comes down the same slope at a constant speed of 40 km/h. Find his average speed over a full circuit.

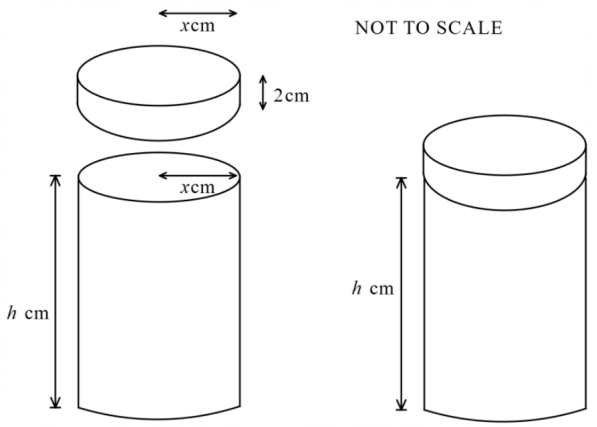
8. Maximum or optimum of a model

Q44 Fort St 2022 Prelim Q8(d) · **6 marks**

A satellite dish has the shape of a parabola, with equation

$$d = \frac{w^2}{800} - 200,$$

where d is the depth of the dish in metres and w is the horizontal distance in metres.



(a) Show, algebraically, that the quadratic function is even.

(b) Find the maximum depth of the dish from the top of the span.

(c) What is the total width of the satellite dish?

(d) Calculate the depth of the dish at a point 100 metres from its endpoint.

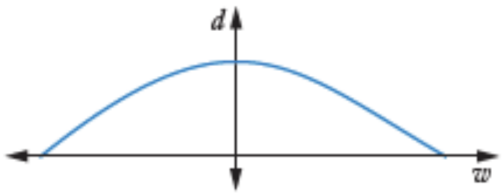
Q45 Roseville 2023 Trial Q11(c) · **1 mark**

Chloe builds a rectangular enclosure against an existing wall using 16 metres of wire fencing, with dimensions x and y satisfying $2x + y = 16$. The area of the enclosure is given by $A = 16x - 2x^2$. Determine the dimensions (both x and y) that will achieve the maximum possible area for the enclosure.

Diagram to be inserted:
`adv-working-with-functions-d6-q45.png`

Q46 Knox 2021 Trial Q12(a) · **5 marks**

Jamjet Industries produce galvanised bolts for the roofing industry. Due to manufacturing constraints, the maximum number of bolts they can produce in a month is 120 000. The cost of production is $50 000 plus 95 cents per bolt. The bolts are sold for $1.75 each and the graph that represents Jamjet's revenue, R, appears on the axes below.



(i) Find the linear equation for the cost, C, of producing n bolts.

(ii) What is the practical significance of the gradient of the line in (i)?

(iii) Find the number of bolts Jamjet must sell in a month to break even.

(iv) What is the maximum monthly profit attainable by Jamjet?

Q47 Killara 2024 Prelim Q33 · **7 marks**

A soccer arena has a maximum capacity of 15 000 spectators. The number of spectators, N, and the ticket price in dollars P, are modelled using the relationship $N = m \times P + c$, where m and c are constants. The following information is known:

- When the price of a ticket is $50, the attendance averages 12 500 spectators.
- When the price of a ticket is $35, the attendance averages 14 000 spectators.

(a) By developing and solving a pair of simultaneous equations, show that the number of spectators as a function of ticket price can be expressed as $N = -100P + 17\,500$.

(b) The revenue generated from an event, R, is calculated using $R = N \times P$. What is the maximum revenue generated from the event?

(c) The manager of this event wants the arena to be filled with 15 000 spectators. Show that this will result in a reduction of revenue by $390 625 from the maximum revenue.