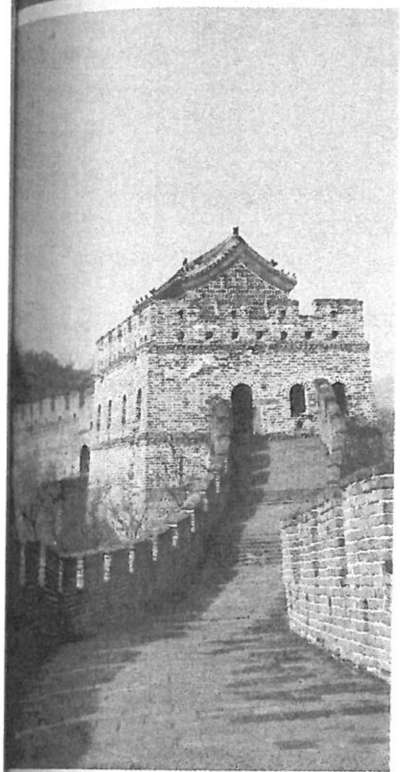
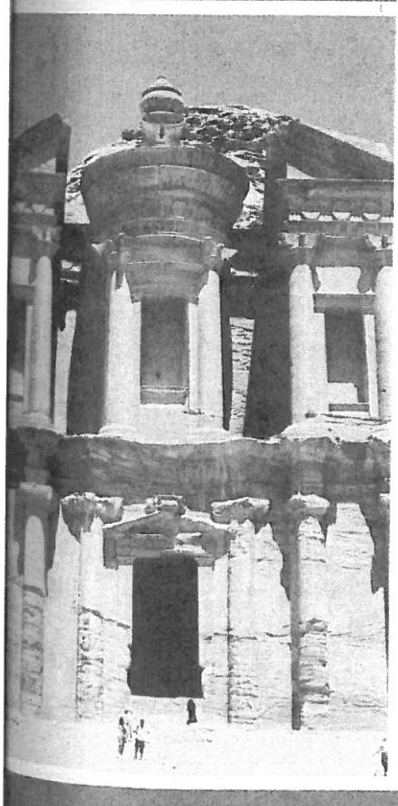
Chapter 9





Line graphs

Contents:

A The Cartesian plane
B Graphing linear relationships
C Graphing lines from equations
D Line graphs
E The intersection of line graphs

Opening problem

Ted the taxi driver charges passengers an initial fee of $5, and then $2 for each kilometre travelled.

Things to think about:

a What is the total cost for a passenger who travels:

i 1 km **ii** 2 km **iii** 3 km **iv** 4 km?

b What do you notice about the values in **a**? What does this tell you about the relationship between the *distance travelled* and the *cost* of the journey?

c What would the graph of *cost* against *distance travelled* look like?

d How could you determine:

i the cost of a 25 km taxi ride **ii** the distance travelled for a cost of $40?

In this Chapter we will study **linear relationships** between variables, and their corresponding **linear graphs**.

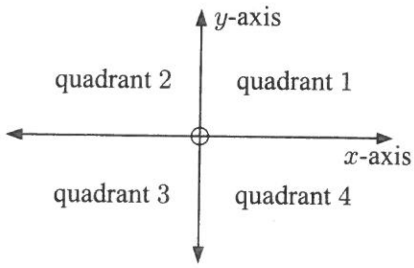
A THE CARTESIAN PLANE

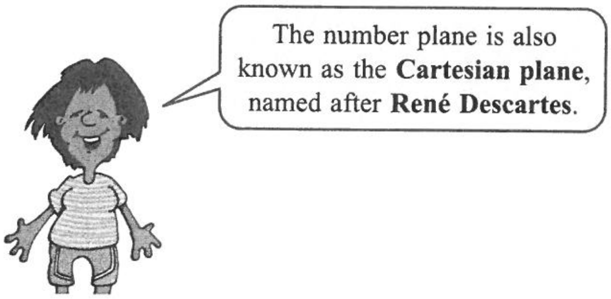
The position of any point in the **number plane** can be specified by an **ordered pair** of numbers (x, y), where:

x is the **horizontal step**
and y is the **vertical step** from a fixed point or **origin** O.

DEMO

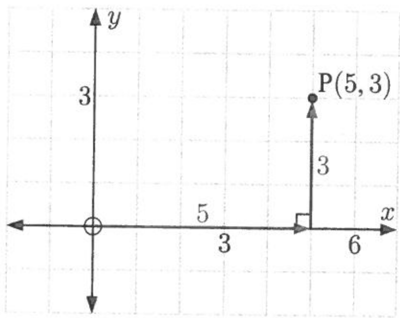
Once the origin O has been located, two perpendicular axes are drawn. The **x-axis** is horizontal and the **y-axis** is vertical. The axes divide the number plane into four **quadrants**.





In the diagram alongside, the point P is at $(5, 3)$. We say that:

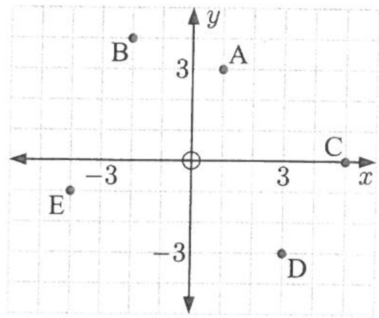
- the **coordinates** of P are $(5, 3)$
- the **x-coordinate** of P is 5
- the **y-coordinate** of P is 3.



The axes are both *directed* number lines, so a horizontal step to the *left* is *negative*, and a vertical step *down* is negative.

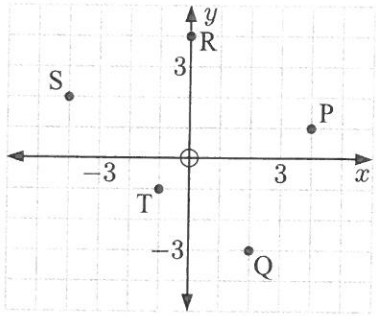
Example 1 — Self Tutor

Plot the points A(1, 3), B(−2, 4), C(5, 0), D(3, −3), and E(−4, −1) on a Cartesian plane.



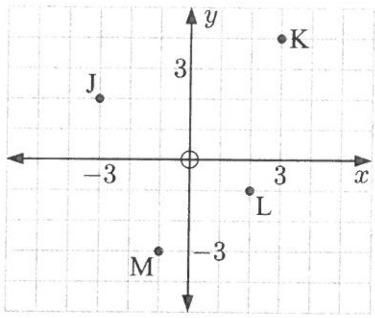
EXERCISE 9A

1 Write down the coordinates of P, Q, R, S, and T.



2 Plot the points A(1, 2), B(−3, 4), C(0, −2), D(5, −1), E(−4, 0), and F(−2, −5) on a Cartesian plane.

3

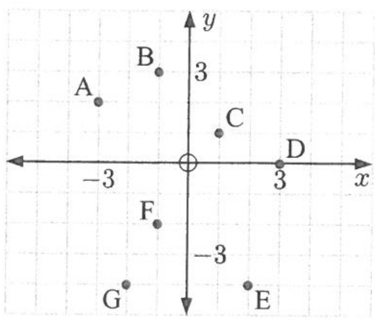


State the:

- **a** coordinates of L
- **b** x-coordinate of M
- **c** y-coordinate of K
- **d** quadrant in which J lies.

4
- **a** Plot the points P(5, 4), Q(−1, 3), R(4, −2), S(−1, −4), and T(−5, −2) on a Cartesian plane.
- **b** Which two points have:
  - **i** the same x-coordinate
  - **ii** the same y-coordinate?
- **c** Which point is in the 1st quadrant?

5
- **a** Find the coordinates of A, B, and C.
- **b** State the y-coordinate of the labelled point with x-coordinate 2.
- **c** State the x-coordinate of the labelled point with y-coordinate −2.



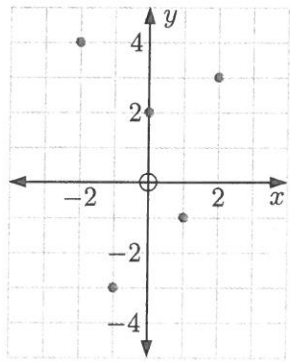
Example 2 — Self Tutor

Plot the points from this table of values.

x	-2	-1	0	1	2
y	4	-3	2	-1	3

When $x = -2$, $y = 4$. So, we plot the point $(-2, 4)$ on the Cartesian plane.

Similarly, we plot the points $(-1, -3)$, $(0, 2)$, $(1, -1)$, and $(2, 3)$.



6 Plot the points from each table of values:

a

x	-2	-1	0	1	2
y	1	-2	4	0	-1

b

x	-2	-1	0	1	2
y	-3	0	2	0	4

c

x	0	1	2	3	4
y	-3	1	3	2	-1

d

x	0	1	2	3	4
y	2	4	4	-1	-4

7 **a** Plot the points from this table of values.

x	0	1	2	3	4
y	-5	-2	1	4	7

b What do you notice about the points you plotted?

c Assuming the pattern continues, state the coordinates of the next two points.

B GRAPHING LINEAR RELATIONSHIPS

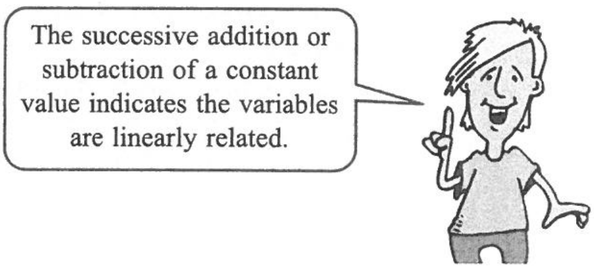
Consider Ted's taxi service in the **Opening Problem**. The *cost* of the taxi ride **depends** on the *distance travelled*, so *cost* is the **dependent variable** and *distance travelled* is the **independent variable**.

We can use a table of values to display the cost ($\$C$) for various distances travelled (d km).

Distance travelled (d km)	0	1	2	3	4
Cost ($\$C$)	5	7	9	11	13

+2 +2 +2 +2

Each time d increases by 1, C increases by 2. This tells us there is a **linear relationship** between d and C.



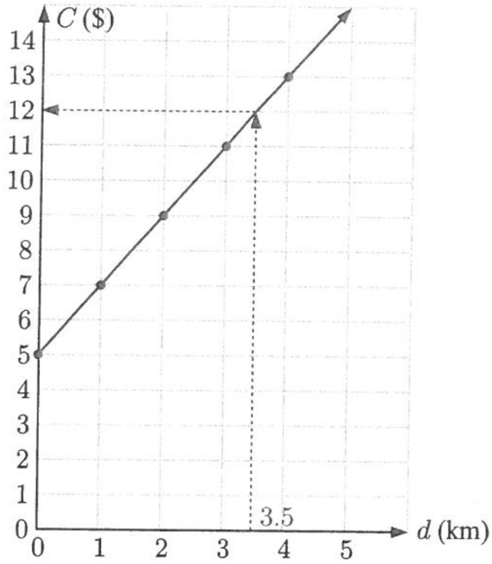
To see a more complete picture of the relationship, we can plot the possible values on a graph.

The independent variable *distance travelled* is on the horizontal axis, and the dependent variable *cost* is on the vertical axis.

Using the table of values, we can plot the points $(0, 5)$, $(1, 7)$, $(2, 9)$, $(3, 11)$, and $(4, 13)$.

Since the variables are linearly related, we can draw a **straight line** through the points.

We can use the graph to find values of the variables not given in the table. For example, the cost of a 3.5 km ride is $12.



Example 3

Self Tutor

The balance of an unused bank account is currently $80. Each year, $5 in bank fees is taken from the account.

a Copy and complete this table of values:

Time (t years)	0	1	2	3	4
Balance ($\$B$)	80				

b Draw the graph of B against t.

c Find the balance of the account after 8 years.

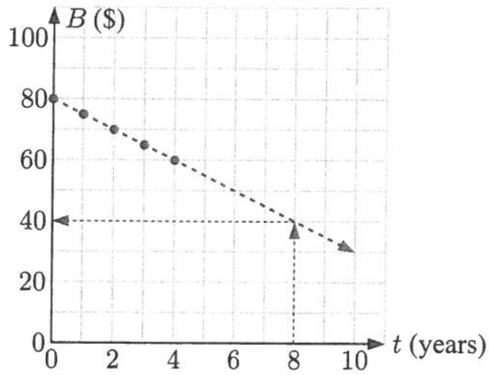
---

a The balance decreases by $5 each year.

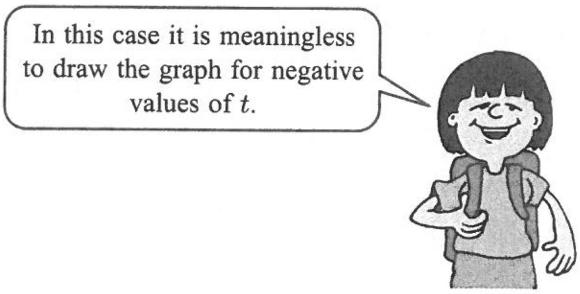
Time (t years)	0	1	2	3	4
Balance ($\$B$)	80	75	70	65	60

$-5 \quad -5 \quad -5 \quad -5$

b



c The balance of the account after 8 years is $40.



EXERCISE 9B.1

1 Consider the table of values alongside.

a Explain why x and y are linearly related.

b Draw the graph of y against x.

c Find the value of y when $x = 8$.

x	0	1	2	3	4
y	6	8	10	12	14

2 A gardener charges a $20 call-out fee, and then $30 for each hour he spends on the job.

a Copy and complete:

Time (t hours)	0	1	2	3	4
Cost ($\$C$)	20				

b Name the dependent and independent variables.

c Are t and C linearly related? Explain your answer.

d Draw the graph of C against t.

e Hence find the cost of a 7 hour job.

3 An esky initially held 60 litres of water, but someone turned the tap on and left it running. Water ran out of the esky at a rate of 2 litres per minute.

a Copy and complete:

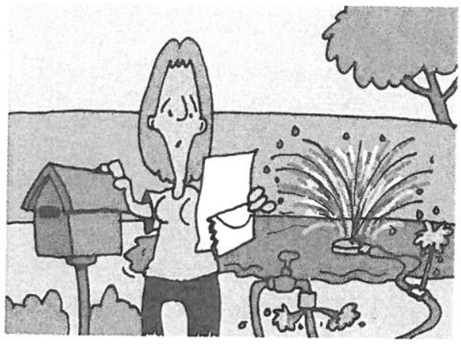
Time after tap was turned on (t minutes)	0	1	2	3	4
Volume remaining in esky (V litres)					

b Explain why t and V are linearly related.

c Draw the graph of V against t.

d Find the volume of water in the esky after 10 minutes.

4 Deb receives a water bill every three months. She is charged a flat $100 service fee, plus $4 for every kilolitre of water that she uses.



a Copy and complete this table of values:

Water used (w kL)	0	10	20	30	40
Cost ($\$C$)					

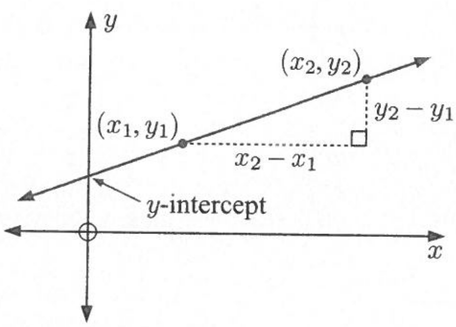
b Draw the graph of C against w.

c Deb used 25 kL of water in the last three months. Find the total amount she needs to pay.

THE GRADIENT AND y-INTERCEPT OF A LINE

Two important characteristics of a linear graph are its **gradient** and **y-intercept**.

- The **gradient** of a line is a measure of its steepness. The gradient of the line passing through (x_1, y_1) and (x_2, y_2) is $\dfrac{y\text{-step}}{x\text{-step}} = \dfrac{y_2 - y_1}{x_2 - x_1}$.
- The **y-intercept** of a line is the value of y at which the line cuts the y-axis.



For the graph of Ted's taxi service on page **197**:

- The line passes through $(0, 5)$ and $(1, 7)$, so the gradient is $\dfrac{7-5}{1-0} = 2$.

  This happens because every kilometre travelled results in a cost increase of $2.
- The C-intercept is 5. This represents the initial fee of $5 for the taxi ride.

Example 4 **Self Tutor**

Adam uses a hose to refill his horse's drinking trough. The volume of water in the trough is recorded at 2-minute intervals.

Time (t minutes)	0	2	4	6	8
Volume (V litres)	30	50	70	90	110

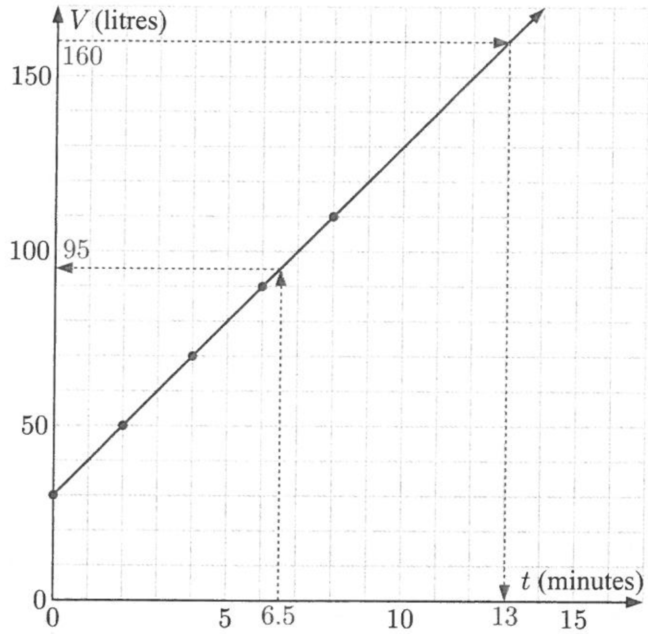
a Draw the graph of V against t.

b Find the gradient and V-intercept of the graph. Interpret your answers.

c Find the volume of water in the trough after 6.5 minutes.

d How long does it take for the volume to reach 160 litres?

a



b The line passes through $(0, 30)$ and $(2, 50)$, so the gradient is $\frac{50-30}{2-0} = 10$.

This means that the volume increases by 10 litres each minute.

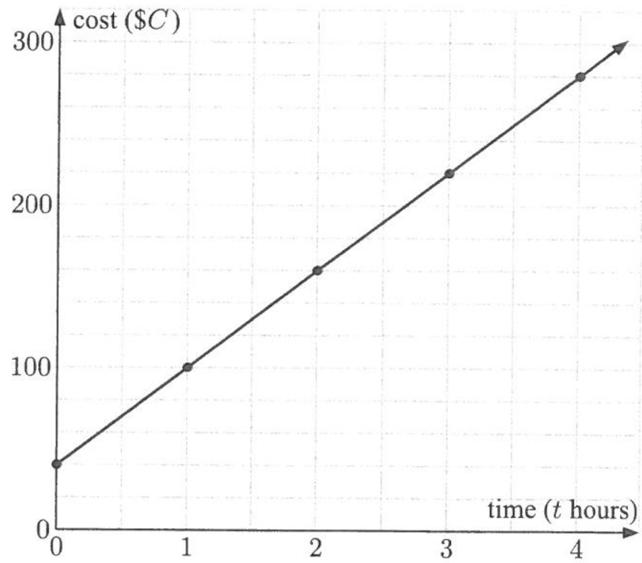
The V-intercept is 30. This means there were 30 litres of water in the trough before Adam began refilling it.

c There were 95 litres of water in the trough after 6.5 minutes.

d It took 13 minutes for the volume to reach 160 litres.

EXERCISE 9B.2

1 This graph shows the relationship between the *time* it takes an electrician to complete a job, and the *cost* of the job.



a Find the gradient and C-intercept of the line. Interpret your answers.

b Find the cost of a job which takes $3\frac{1}{2}$ hours.

c If the cost of a job is $130, how long did the job take?

2 Consider the table of values alongside.

x	0	2	4	6	8
y	10	16	22	28	34

a Draw the graph of y against x.

b What feature of the graph indicates that x and y are linearly related?

c Find the gradient and y-intercept of the graph.

3 This table shows the battery charge in a mobile phone x hours after being unplugged from the charger.

Time (x hours)	0	1	2	3
Charge (y%)	84	78	72	66

a Draw a graph of y against x.

b Find the gradient and y-intercept of the line. Interpret your answers.

c Find the charge in the phone after 1.5 hours.

d How long will it take for the phone to run out of charge?

4 The table alongside shows the costs of carpeting rooms of various areas.

Area (a m^2)	10	20	30	40
Cost (\$$C$)	300	500	700	900

a Draw a graph of C against a.

b Find the gradient and C-intercept of the line. Interpret your answers.

c Find the cost of carpeting a 25 m^2 room.

d Donna's lounge room is 6 m by 6 m. Is \$850 sufficient for her to carpet her lounge room?

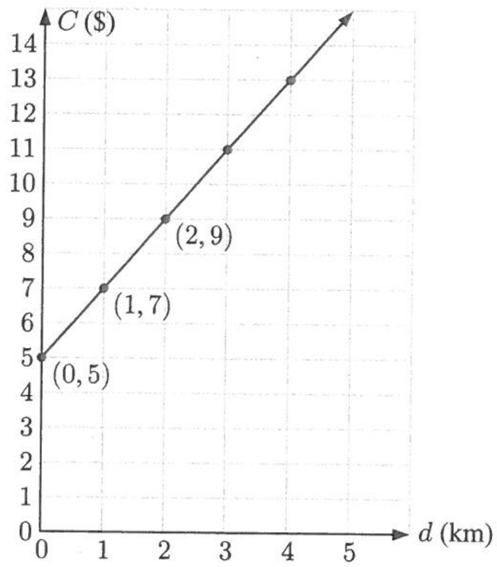
C GRAPHING LINES FROM EQUATIONS

The **equation of a line** is a rule which connects the variables for **all** points on the line.

For example, in the **Opening Problem**, the equation connecting C and d is $C = 2d + 5$.

We can substitute values of d into this equation to obtain the corresponding values of C. For example:

- when $d = 0$, $C = 2(0) + 5 = 5$
- when $d = 1$, $C = 2(1) + 5 = 7$
- when $d = 2$, $C = 2(2) + 5 = 9$



If we are given the equation of a line, we can draw its graph using:

- a **table of values**, *or*
- the **gradient** and **y-intercept**.

USING A TABLE OF VALUES

In this method, we substitute various values of x into the equation to obtain the corresponding value of y. We then plot points on a Cartesian plane, and join the points with a straight line.

Example 5 — Self Tutor

Draw the graph of $y = 3x - 1$.

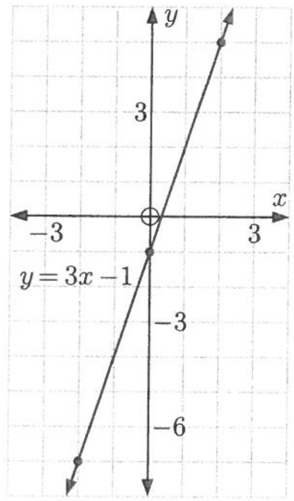
When $x = -2$, $y = 3(-2) - 1$
$= -7$

When $x = 0$, $y = 3(0) - 1$
$= -1$

When $x = 2$, $y = 3(2) - 1$
$= 5$

The table of values is:

x	-2	0	2
y	-7	-1	5



EXERCISE 9C.1

1 Use a table of values with $x = -2$, 0, and 2 to draw the graph of:

- **a** $y = x + 1$
- **b** $y = 2x - 1$
- **c** $y = x - 4$
- **d** $y = 3x + 2$
- **e** $y = -x + 3$
- **f** $y = -2x - 5$

Use technology to check your answers.

GRAPHING PACKAGE

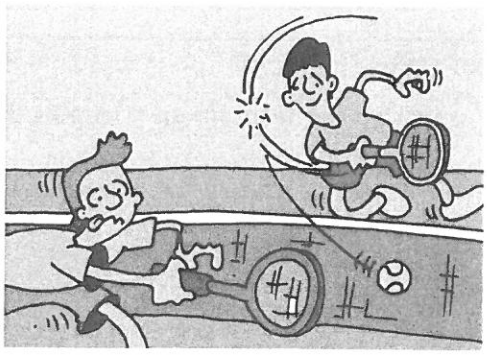
2 Use a table of values with $x = -2, -1, 0, 1$, and 2 to draw the graph of:

- **a** $y = \frac{1}{2}x + 3$
- **b** $y = \frac{3}{2}x - 1$
- **c** $y = -\frac{1}{2}x - 4$

Use technology to check your answers.

GRAPHICS CALCULATOR INSTRUCTIONS

3 The cost of hiring a tennis court for t hours is $C = 15 + 10t$ dollars.



- **a** Copy and complete this table of values:

t (hours)	0	2	4
C (\$)			

- **b** Draw the graph of C against t for $t \geqslant 0$.
- **c** Find the cost of hiring the court for $2\frac{1}{2}$ hours.
- **d** Explain why it would not make sense to plot a point corresponding to $t = -2$.

4 The height of a candle t hours after it is lit, is $H = 90 - 5t$ mm.

a Copy and complete this table of values:

t (hours)	0	2	4
H (mm)			

b Draw the graph of H against t for $t \geqslant 0$.

c Find the height of the candle after 3 hours.

d How long will it take for the height of the candle to reduce to 5 cm tall?

Discussion

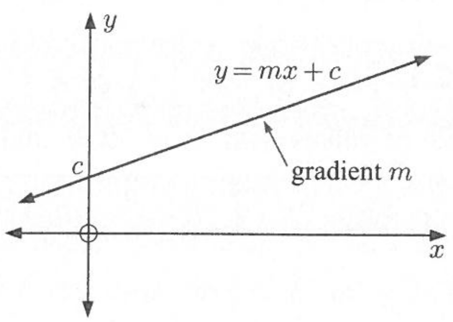
Find the gradient and y-intercept of each graph you drew in question **1**.

Can you see how the gradient and y-intercept of a line relate to the equation of the line?

USING THE GRADIENT AND y-INTERCEPT

In previous years, we have seen that:

The line with equation $y = mx + c$ has gradient m and y-intercept c.

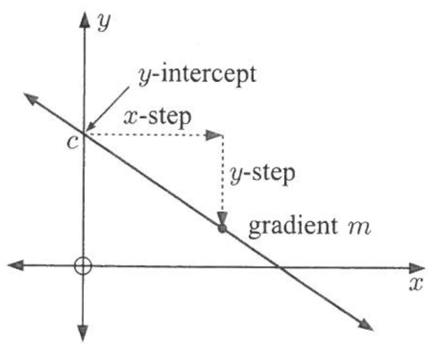


For example:

- The line with equation $y = 5x - 2$ has gradient 5 and y-intercept -2.
- The line with equation $y = -\frac{1}{3}x + 4$ has gradient $-\frac{1}{3}$ and y-intercept 4.

To draw the graph of $y = mx + c$ we:

- Use the y-intercept c to plot the point $(0, c)$.
- Use x and y-steps from the gradient m to locate another point on the line.
- Join the two points and extend the line in either direction.

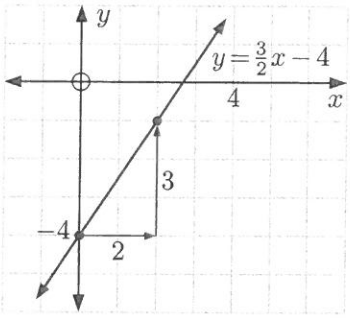


Example 6 🔊 **Self Tutor**

Draw the graph of $y = \frac{3}{2}x - 4$.

For $y = \frac{3}{2}x - 4$:

- the y-intercept is $c = -4$
- the gradient is $m = \frac{3}{2}$ ← y-step, ← x-step



EXERCISE 9C.2

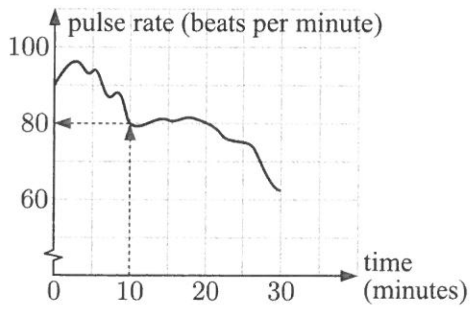
GRAPHING PACKAGE

1. Consider the line with equation $y = \frac{1}{2}x + 3$.
   a. State the gradient and y-intercept of the line.
   b. Draw the graph of the line. Use technology to check your answer.
2. Draw the graph of:
   a. $y = 3x + 2$
   b. $y = 2x - 4$
   c. $y = \frac{1}{3}x + 1$
   d. $y = \frac{3}{5}x$
   e. $y = \frac{3}{2}x - 1$
   f. $y = -2x + 1$
   g. $y = -x - 5$
   h. $y = -\frac{2}{3}x + 2$
   i. $y = -\frac{5}{4}x - 3$
3. Nigel helps his parents at their shoe store. The wage he is paid each day is $W = 20n + 10$ dollars, where n is the number of shoe sales he makes.
   a. Draw the graph of W against n.
   b. How much would Nigel earn if he made 10 sales in a day?
4. The weight of chicken pellets in a feed bowl after t hours is $W = 60 - 12t$ grams.
   a. Draw the graph of W against t.
   b. What weight of chicken pellets is in the bowl after 3 hours?
   c. How long will it take for the pellets to run out?

D LINE GRAPHS

A **line graph** consists of a curve, or a series of straight line segments, which shows the relationship between two quantities.

This line graph shows the pulse rate of a hospital patient over a 30 minute period.



We can use the graph to determine the pulse rate at a particular time. For example, after 10 minutes, the patient's pulse rate is 80 beats per minute.

The graph also allows us to identify trends in the data. For example, we can see that as time passes, the patient's pulse rate is generally decreasing.

EXERCISE 9D.1

1 This line graph shows the height of a balloon above the ground after it was thrown into the air.

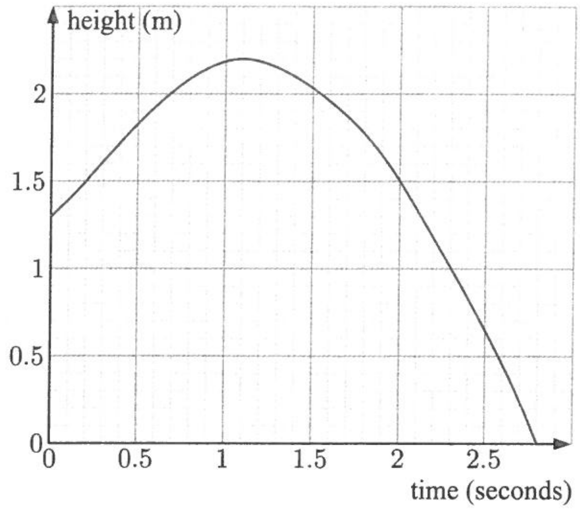
Estimate:

a the height of the balloon after 2 seconds

b the times at which the balloon was 1.5 m above the ground

c the maximum height reached by the balloon

d how long it took for the balloon to fall to the ground.



2 This line graph shows the temperature conversion between degrees Celsius (°C) and degrees Fahrenheit (°F).

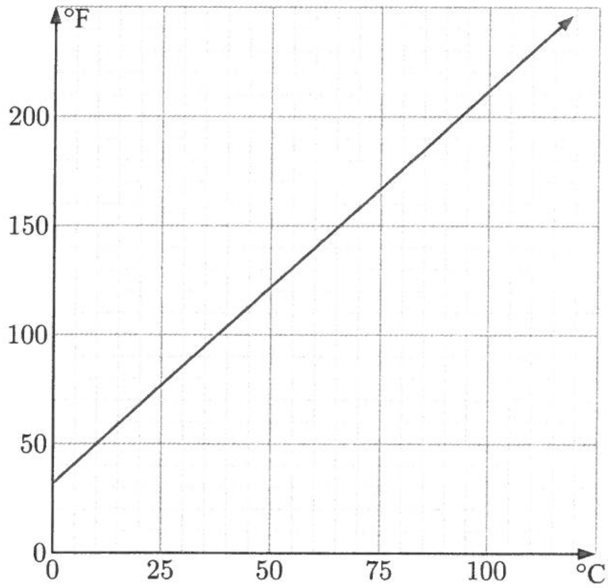
a Write in °F:

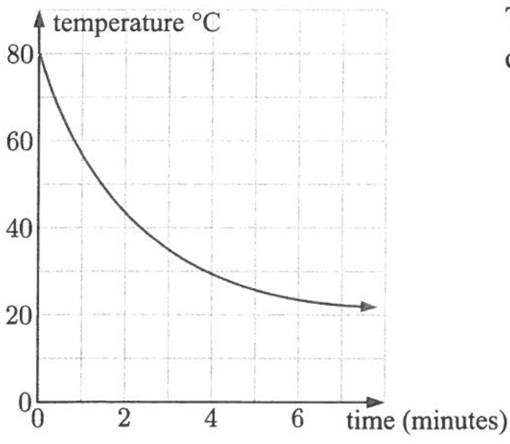
i 50°C **ii** 90°C

b Write in °C:

i 150°F **ii** 50°F

c Water freezes at 0°C. Write this temperature in °F.



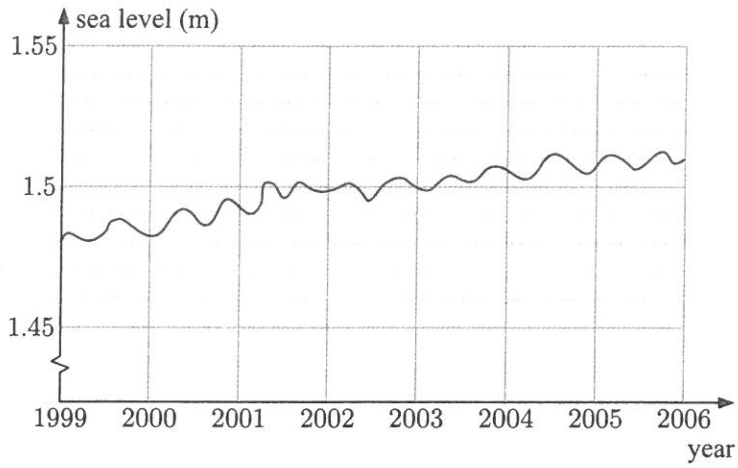
3 

This line graph shows the temperature of a cup of coffee after it has been made.

a Find the initial temperature of the coffee.

b Estimate the temperature of the coffee after 3 minutes.

c Describe how the temperature of the coffee changes in the first 7 minutes.

4 

This line graph shows the average sea level near a port over a 7 year period.

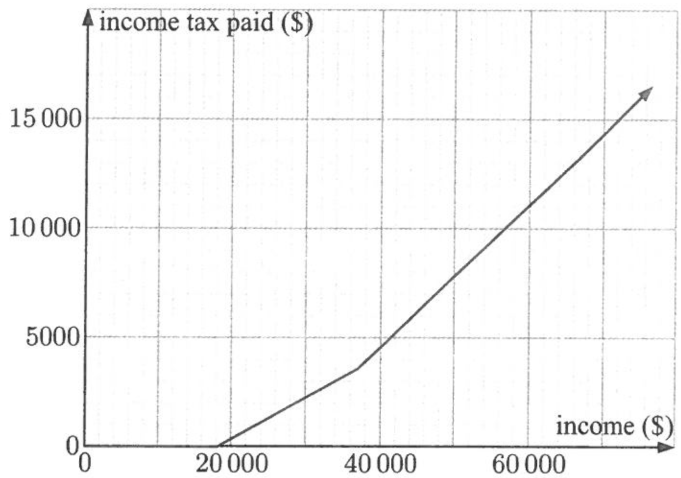
a Estimate the sea level at the start of:

i 2003 **ii** 2006

b Describe the *overall trend* over the 7 year period.

c Is there an *annual trend* that occurs each year? Discuss your answer.

5 This line graph shows the relationship between a person's annual income and the income tax they need to pay.



a John earned $50 000 last year. How much income tax did he pay?

b People earning below a certain amount called the *tax free threshold* do not pay any income tax. Estimate the tax free threshold.

c The graph consists of three straight line segments.

i Which of the line segments has the steepest gradient?

ii Describe how the income tax paid changes as a person's income increases.

Example 7

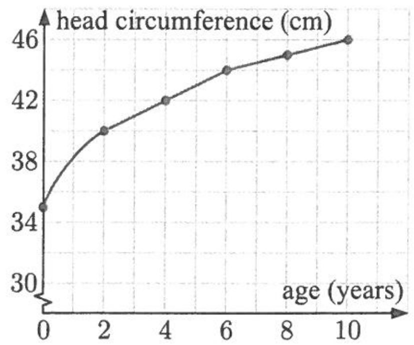
Self Tutor

The circumference of Warren's head was measured every 2 years from birth.

Age (years)	0	2	4	6	8	10
Head circumference (cm)	35	40	42	44	45	46

a Draw a line graph of Warren's head circumference over time.

b Describe the trend of the graph.

a 

b Warren's head circumference increased quickly at first. The rate slowed down over time, and we would expect that once Warren reaches adulthood it would stop increasing altogether.

6 The number of wombats in a region of bushland was recorded at yearly intervals.

Year	2003	2004	2005	2006	2007	2008	2009	2010
Number of wombats	300	378	455	482	490	488	491	490

a Draw a line graph to display this data.

b Describe how the wombat population has changed over time.

7 Peter recorded the distance he walked each day during February:

Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Distance (km)	3.82	4.68	4.69	2.41	3.22	3.25	4.09	5.90	3.76	5.70	2.82	1.89	2.50	4.25

Day	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Distance (km)	4.93	4.67	3.48	2.92	4.25	3.42	3.42	3.84	4.77	2.77	3.08	2.28	4.38	5.01

a Draw a line graph to display the data.

b On how many days during February did Peter walk more than 4 km?

c On which day was Peter most active?

8 A print shop offers discounts for printing brochures in bulk. The first 200 brochures cost 50 c per copy. Additional brochures cost 30 c per copy.

a Copy and complete:

Number of brochures	0	50	100	150	200	250	300	350
Cost ($)								

b Draw a line graph to display the data. Extend your line graph to 700 brochures.

c Explain why the graph involves line segments with different gradients.

d Find the cost of printing 500 brochures.

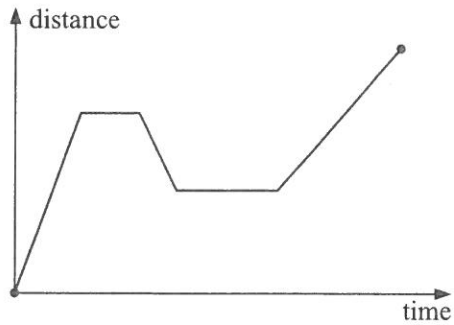
e Ellen spent $175 on brochures to advertise her business. How many brochures did she print?

TRAVEL GRAPHS

A **travel graph** for a journey is a line graph which shows the distance the traveller is from their starting point at a particular time. If the traveller keeps moving in the same direction, the graph will show the total distance travelled against the time take to travel it.

For any line segment on the graph:

- a **positive** gradient indicates that the traveller is moving away from the starting point
- a **negative** gradient indicates that the traveller is moving back towards the starting point
- the size of the gradient is the **average speed** of the traveller for that section of the journey.



Example 8 **Self Tutor**

This travel graph shows Ron's distance from home during a motorcycle trip.

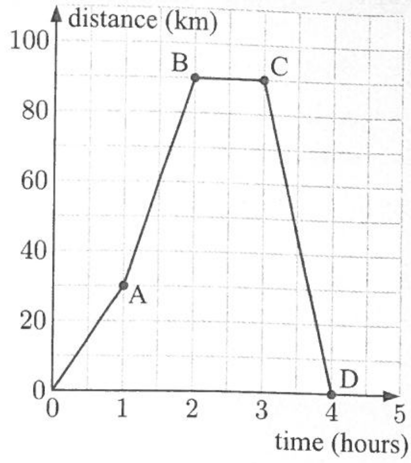
a How long did the trip take?

b How far did Ron travel?

c Find the gradient of:

  i [AB] **ii** [CD].

  Interpret your answers.



a The trip took 4 hours.

b Ron travelled 90 km to his destination, and 90 km back.

$\therefore$ Ron travelled 90 km + 90 km = 180 km.

c **i** A is (1, 30), B is (2, 90).

$\therefore$ gradient of [AB] $= \dfrac{90-30}{2-1} = \dfrac{60}{1} = 60$

From A to B, Ron is moving away from A at an average speed of 60 km/h.

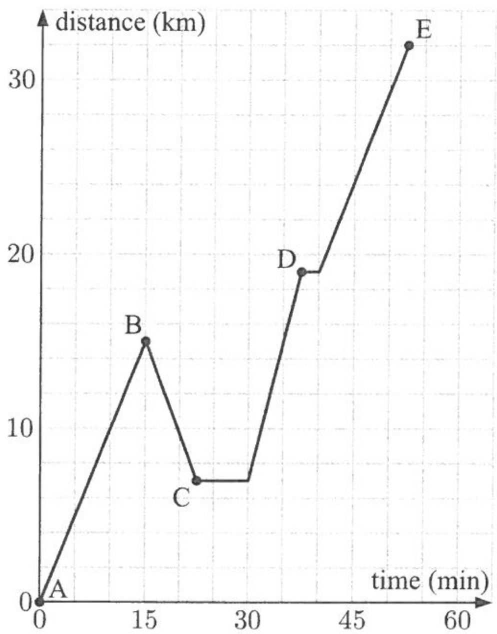
ii C is (3, 90), D is (4, 0).

$\therefore$ gradient of [CD] $= \dfrac{0-90}{4-3} = \dfrac{-90}{1} = -90$

From C to D, Ron is moving back towards his starting point at an average speed of 90 km/h.

EXERCISE 9D.2

1



This travel graph shows Jamie's journey as he drove from his house to a restaurant.

Match the following actions with the corresponding points on the graph:

a arrived at the restaurant

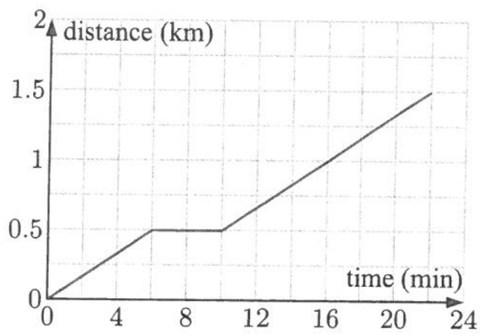
b stopped at traffic lights

c stopped at a petrol station

d performed a U-turn

e left the house.

2 This travel graph shows Kelly's journey as she walked to work.



a How far does Kelly live from her workplace?

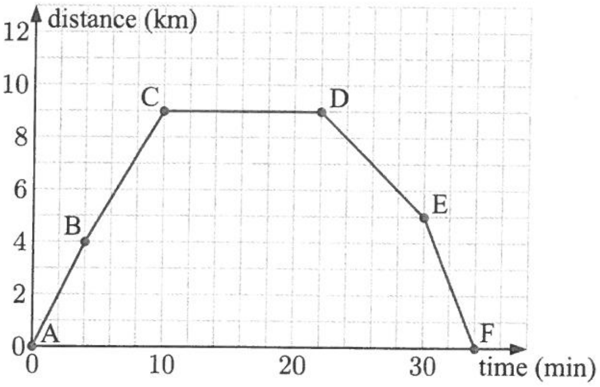
b How long did Kelly take to walk to work?

c Kelly stopped at a café to buy a chai latte before work.

i How much time did Kelly spend at the café?

ii How far is the café from Kelly's workplace?

3



Josh drove his car to the local shopping centre to buy groceries.

a How far does Josh live from the shopping centre?

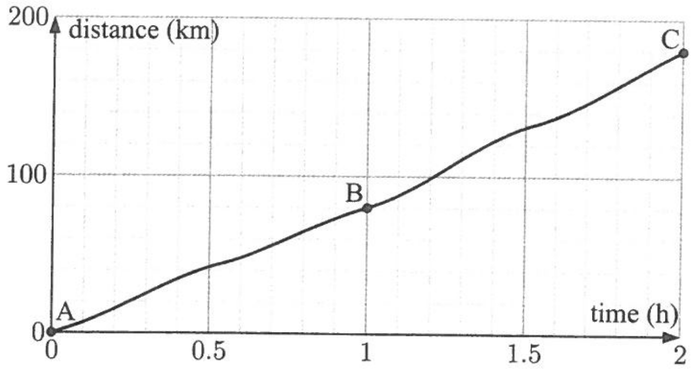
b How long did Josh spend at the shopping centre?

c Find the gradient of:

i [AB] **ii** [DE].

Interpret your answers.

4 This travel graph shows Liam's journey from Perth to Bunbury.



a What is the distance between Perth and Bunbury?

b **i** How long did it take Liam to reach his destination?

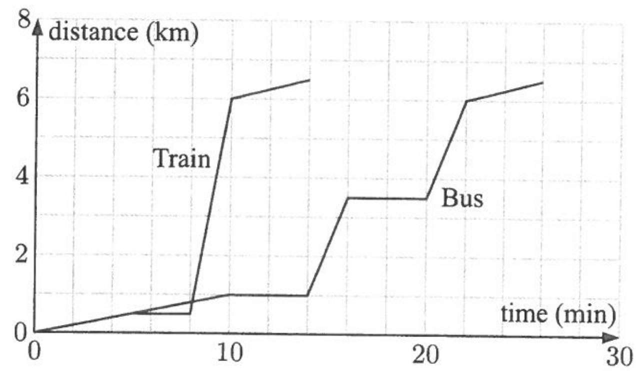
ii If Liam arrived in Bunbury at 10 am, at what time did he leave Perth?

c Calculate Liam's average speed:

i from A to B **ii** over the whole journey.

5 On Monday, Thuy rode a bus to school. On Tuesday, she caught a train.

This travel graph shows a comparison of her journeys.



a How far does Thuy have to travel to school?

b How long does it take Thuy to walk from her house to the bus stop?

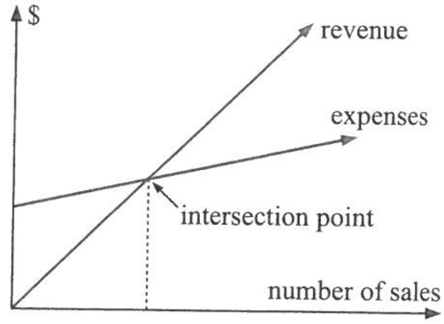
c How far does Thuy walk from the train station to her school?

d How much less time did it take Thuy to get to school using the train compared with the bus?

E THE INTERSECTION OF LINE GRAPHS

It is often useful to draw two linear graphs on the same set of axes.

For example, a business can graph its **revenue** and **expenses** against the number of sales. The point of intersection tells us the number of sales at which revenue and expenses are equal. At this number of sales the business "breaks even".



Where necessary, you can use a **graphics calculator** or the **graphing package** to help draw the graphs and find the intersection point.

GRAPHING PACKAGE

GRAPHICS CALCULATOR INSTRUCTIONS

Example 9

Self Tutor

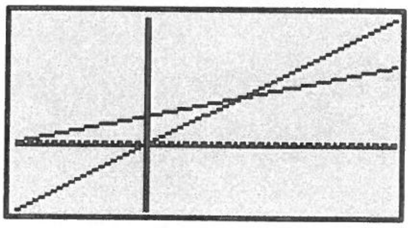
Jeanne operates a pie cart. Her revenue from selling n pies per day is $R = 5n$ dollars, and the cost of making n pies per day is $C = 2n + 60$ dollars.

a Draw both graphs on the same set of axes.

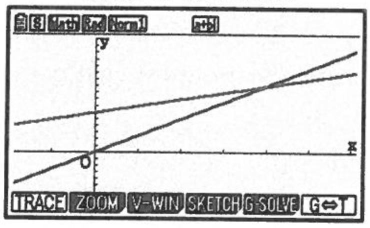
b How many pies does Jeanne need to sell each day in order to break even?

a We use technology to graph $Y_1 = 5X$ and $Y_2 = 2X + 60$ on the same set of axes.

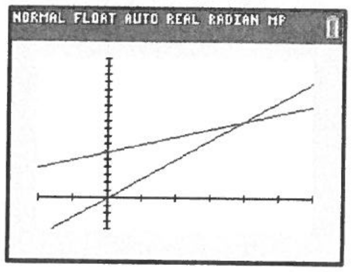
Casio fx-9860G PLUS



Casio fx-CG20 AU

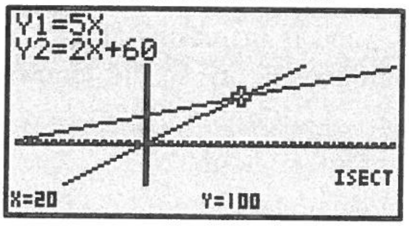


TI-84 Plus CE



b We use technology to find where the graphs intersect.

Casio fx-9860G PLUS



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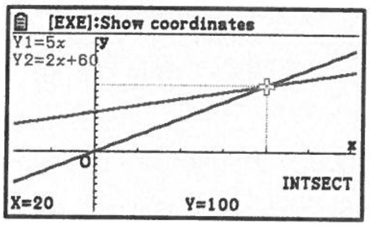

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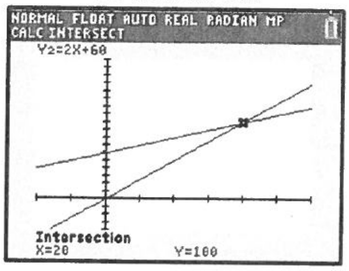


The graphs intersect at (20, 100).

$\therefore$ Jeanne must sell 20 pies each day in order to break even.

EXERCISE 9E

1 A company sells boxes of self adhesive labels. The revenue from selling n boxes per day is $R = 6n$ dollars, and the cost of making n boxes per day is $C = 2n + 100$ dollars.

a Draw both graphs on the same set of axes.

b How many boxes must the company sell per day to break even?

c What is the revenue and cost to the company at this break-even level of sales?

2 International power adaptors sell for \$7 each. The adaptors cost \$3 each to make, with fixed costs of \$200 per day regardless of the number made.

a Write an expression for the:

i revenue when n adaptors are sold per day

ii total expenses when n adaptors are made per day.

b Draw the graphs for revenue and expenses on the same set of axes.

c Suppose 30 adaptors are sold in a day.

i Find the revenue and expenses for the day.

ii Did the company make a profit or a loss? Explain your answer.

d How many adaptors must be sold each day in order to break even?

3 Peter is planning his daughter's birthday party. He is unsure whether to hire a clown or a bouncy castle. The cost of hiring the clown for t hours is $C = 40 + 30t$ dollars, and the cost of hiring the bouncy castle for t hours is $B = 100 + 10t$ dollars.

a Draw both graphs on the same set of axes.

b Is it cheaper to hire the clown or the bouncy castle for 1 hour?

c Find the hire time for which the hire costs are equal.

4 On a hot day, the temperature in Janet's lounge is 21°C, and is increasing at 1°C per hour. The temperature in her study is 33°C, but the air conditioner is on, so the temperature is decreasing at 2°C per hour.

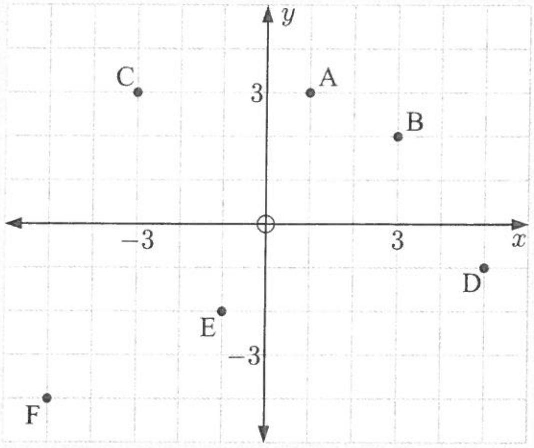
a Write an expression for the temperature in each room after t hours.

b Draw both graphs on the same set of axes.

c **i** How long will it take for the temperature to be the same for both rooms?

ii What will the temperature in each room be at this time?

Review set 9A

1 

Write down the coordinates of A, B, C, D, E, and F.

2 **a** Plot the points J(2, 4), K(0, 1), L(2, 0), and M(−3, 1) on a Cartesian plane.

b Which two points have the same:

i x-coordinate **ii** y-coordinate?

c Which point lies:

i on the x-axis **ii** on the y-axis **iii** in the 2nd quadrant?

3 Eric invested \$1000 in a simple interest account. The amount in the account increased by \$50 each year.

a Copy and complete this table of values.

Time (t years)	0	1	2	3
Amount (\$$A$)	1000			

b Are the variables linearly related? Explain your answer.

c Draw the graph of A against t.

d Hence find the amount in the account after 6 years.

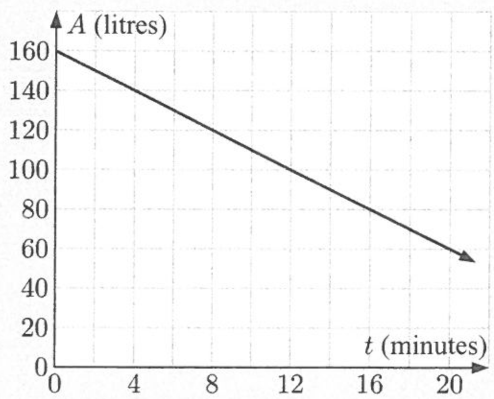
4 Consider the table of values alongside.

x	0	5	10	15	20
y	20	18	16	14	12

a Draw the graph of y against x.

b What feature of the graph indicates that x and y are linearly related?

c Find the gradient and y-intercept of the graph.

5 

The amount of oil A left in a leaky barrel after t minutes is shown on the graph alongside.

a Find the gradient and A-intercept of the line. Interpret your answers.

b How much oil is left after 8 minutes?

c How long will it take before there are only 80 litres of oil left?

6 Use a table of values with $x = -2$, 0, and 2 to draw the graph of:

a $y = x - 2$ **b** $y = 2x + 3$ **c** $y = -\frac{1}{2}x + 1$

7 Consider the line with equation $y = -\frac{2}{3}x + 4$.

a State the gradient and y-intercept of the line.

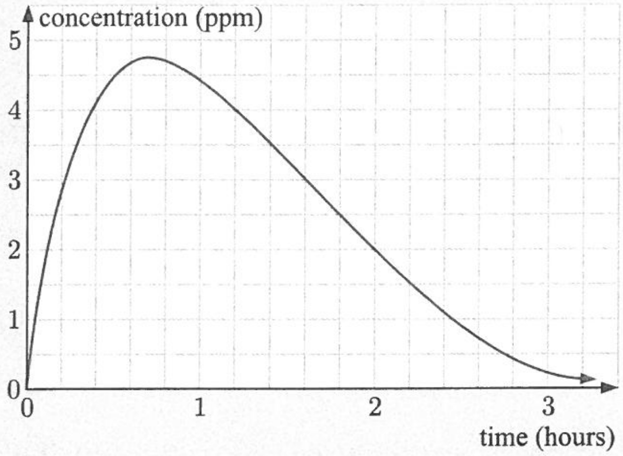
b Draw the graph of the line.

8 The profit made selling n glasses of lemonade is $P = 4n - 10$ dollars.

a Draw the graph of P against n.

b How much profit would be made by selling 8 glasses of lemonade?

9



This line graph shows the concentration of a drug in a person's bloodstream t hours after a tablet is taken.

a Estimate the concentration of the drug after 2 hours.

b Estimate the time at which the drug concentration is highest.

c Describe how the concentration of the drug changes in the first 3 hours.

10 Waverley Manufacturing produces carburettors for motor vehicles. The revenue from selling n carburettors per day is $R = 60n$ dollars, and the cost of making n carburettors per day is $C = 30n + 150$ dollars.

a Draw both graphs on the same set of axes.

b How many carburettors must the company sell per day to break even?

c What is the revenue and cost to the company at this break-even number of sales?

Review set 9B

1 Plot the points P(−4, 0), Q(−2, 5), R(3, 1), S(−1, −5), and T(5, 4) on a Cartesian plane.

2 Plot the points from each table of values:

a

x	−2	−1	0	1	2
y	−3	5	−1	−2	5

b

x	0	1	2	3	4
y	−1	−1	1	4	3

3 A computer technician charges a call-out fee of \$40, then adds \$30 per hour of service.

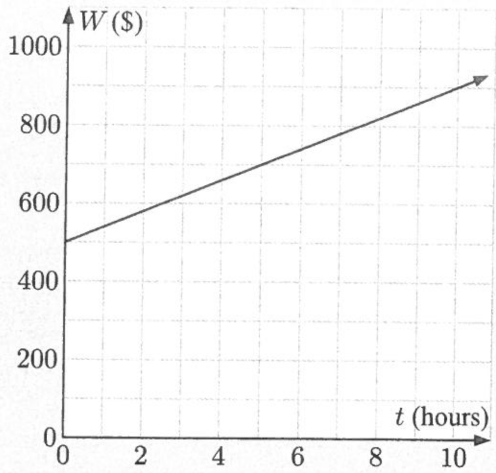
a Copy and complete the table alongside.

Time (t hours)	0	1	2	3	4
Cost (\$$C$)					

b Draw the graph of C against t.

c Find the cost of a job which takes $2\frac{1}{2}$ hours.

4 This graph shows the weekly wage $\$W$ Kenneth receives when he works t hours of overtime.



a Find the gradient and W-intercept of the line. Interpret your answers.

b Find:

i Kenneth's weekly wage when he works 5 hours of overtime

ii the amount of overtime needed for a weekly wage of $800.

5 Rohan's lawn mower cuts grass to a height of 17 mm. The grass grows 3 mm each day.

a Construct a table of values for the height H of the lawn d days after it is cut, for $d = 0, 1, 2, 3, 4$.

b Use your table to graph H against d.

c Find the height of the lawn after 7 days.

6 The cost of hiring a tiler for t hours is $C = 50 + 35t$ dollars.

a Copy and complete this table of values:

t (hours)	0	2	4	6
C ($)				

b Draw the graph of C against t for $t \geqslant 0$.

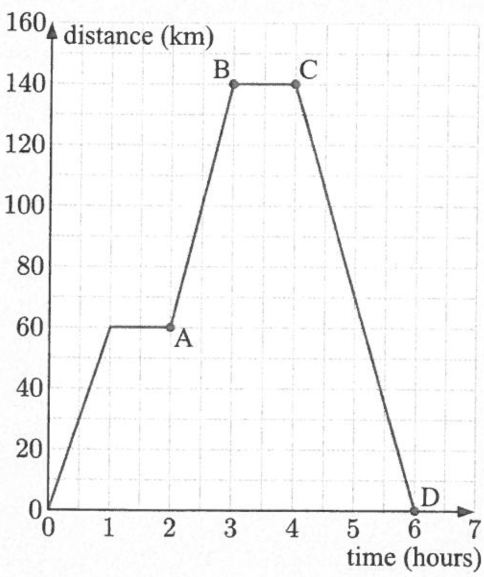
c How much will it cost to hire the tiler for 5 hours?

d Explain why it makes no sense to talk about $t < 0$.

7 Use the gradient and y-intercept to draw the graph of:

a $y = 4x - 2$ **b** $y = \frac{3}{5}x + 1$ **c** $y = -2x + 5$

8 This travel graph shows Marie's distance from home during a road trip.



a How long did it take Marie to arrive at her destination?

b How far did Marie travel in total?

c Find the gradient of:

i [AB] **ii** [BC] **iii** [CD].

Interpret your answers.

9 The average monthly rainfall for Wollongong is shown in the table below.

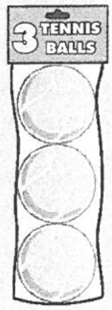
Month	Jan	Feb	Mar	Apr	May	Jun
Average rainfall (mm)	130.3	156	160.4	129.3	106.4	112.4

Month	Jul	Aug	Sep	Oct	Nov	Dec
Average rainfall (mm)	63.4	83.3	67.4	100.5	115.6	94.6

a Draw a line graph to display this data.

b Describe how the average monthly rainfall changes throughout the year.

10 Tennis balls are sold in packs of 3 for \$12 per pack. The balls cost \$2 each to produce, with fixed factory running costs of \$1200 per day.



a Write an expression for the:

i revenue when n tennis balls are sold per day

ii total expenses when n tennis balls are made per day.

b Draw the graphs for revenue and total expenses on the same set of axes.

c How many *packs* of tennis balls must be sold per day in order to break even?