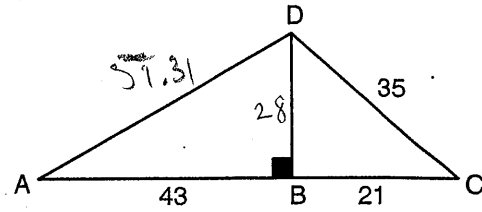
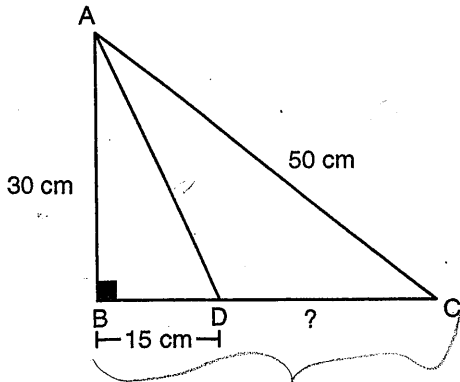


# Pythagorean Theorem

In the triangle shown below, what is the measure of segment AD?



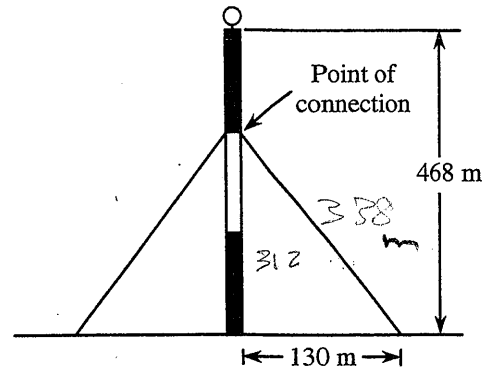
What is the length of  $\overline{DC}$ ?



25 cm

Two cables are used to support a telecommunications antenna. The antenna has a height of 468m and the cables are each anchored 130 m from the base.

The point at which each cable is connected is  $\frac{2}{3}$  of the height of the antenna. **What is the length of each cable?**



$$468 \cdot \frac{2}{3} = 312 \quad \sqrt{312^2 + 130^2}$$

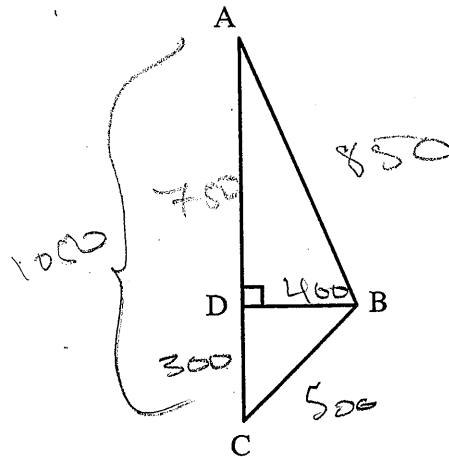
A farmer planted wheat in a triangular field.

$$m \overline{AB} = 850 \text{ m}$$

$$m \overline{BC} = 500 \text{ m}$$

$$m \overline{DC} = 300 \text{ m}$$

**How many hectares ( $\text{hm}^2$ ) were planted?**



$$\sqrt{850^2 - 400^2}$$

$$\sqrt{562500}$$

$$\frac{1050 \cdot 400}{2} = 210000 \text{ m}^2$$

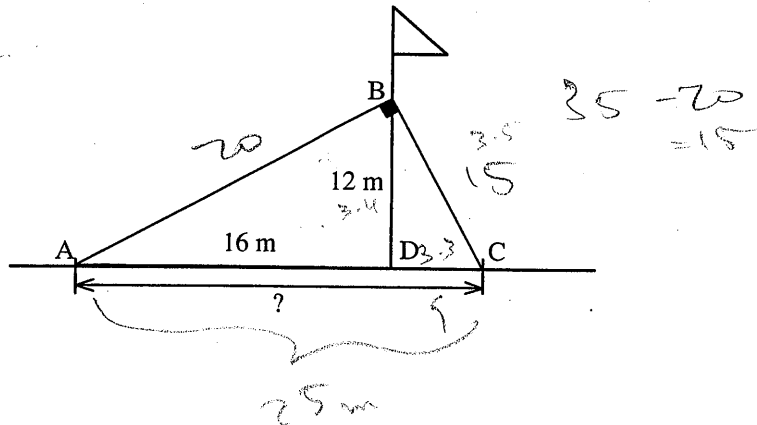
$$= 21 \text{ hm}^2$$

# Pythagorean Theorem

A flag pole is supported by two cables, as shown in the diagram below. These cables are perpendicular to one another at point B, where they are attached to the flag pole. They are anchored to the ground at point A and at point C. The two cables measure a total of 35 m.

$$m \overline{BD} = 12 \text{ m}$$

$$m \overline{AD} = 16 \text{ m}$$



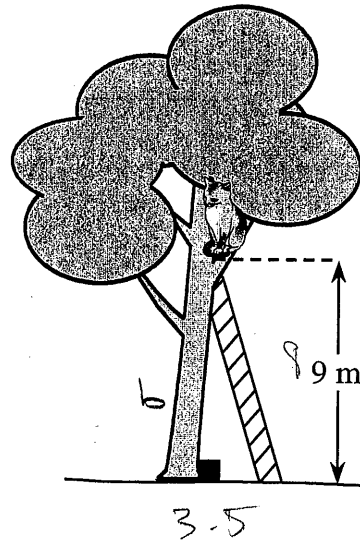
**What is the distance between point A and point C?**

Calvin's cat is stuck in a tree.

The cat is 9 m above the ground.

A person trying to rescue the cat places an 8 m ladder 3.5 m from the base of the tree.

**To the nearest tenth of a metre, how far is the cat from the top of the ladder?**



$$\sqrt{8^2 - 3.5^2}$$

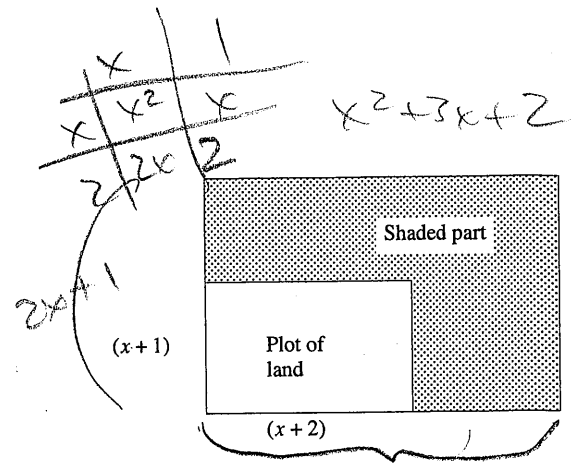
$$= 7.19 \text{ m}$$

$$9 - 7.19 =$$

$$1.81 \text{ m}$$

# Polynomials

- 1 A rectangular plot is  $(x + 2)$  metres long and  $(x + 1)$  metres wide. Its length is increased by 3 metres and its width by  $x$  metres.

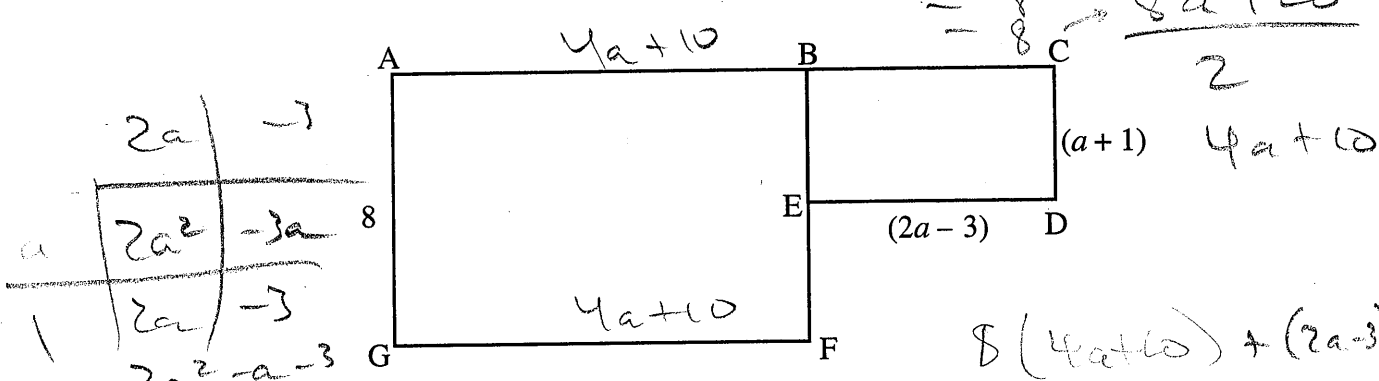


$$\begin{array}{r} 2x \phantom{0} \\ \times 2x^2 \phantom{0} \\ \hline 4x^2 \phantom{0} \end{array}$$

$$\begin{array}{r} 2x^2 + 11x + 5 \\ - (x^2 + 3x + 2) \\ \hline x^2 + 8x + 3 \end{array}$$

What simplified algebraic expression can be used to represent the area of the shaded part?

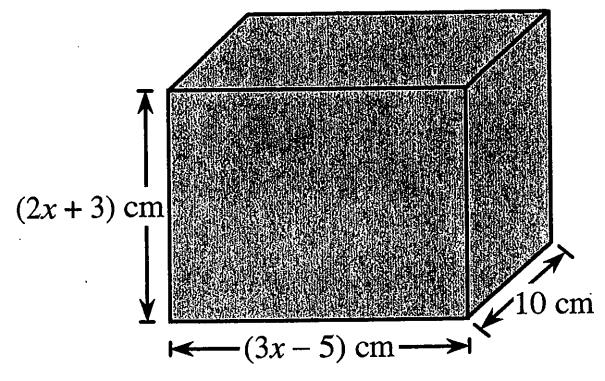
- 2 In the figure below, the perimeter of rectangle ABEF is  $(8a + 36)$  m.



Calculate the total area of this figure.

$$\begin{aligned} & 8(4a + 10) + (2a - 3)(a + 1) \\ & 32a + 80 + 2a^2 - a - 3 \\ & 2a^2 + 31a + 77 \end{aligned}$$

- 3 What algebraic expression corresponds to the volume of the prism?



$$\begin{aligned} & (2x + 3)(3x - 5)(10) \\ & (2x + 3)(30x - 50) \\ & \begin{array}{r} 2x \phantom{0} \phantom{0} \\ \times 30x \phantom{0} \phantom{0} \\ \phantom{0} \times 30x \phantom{0} \phantom{0} \\ \hline 60x^2 \phantom{0} \phantom{0} \phantom{0} \\ -100x \phantom{0} \phantom{0} \phantom{0} \\ \hline 60x^2 - 100x - 150 \end{array} \end{aligned}$$

$$2(3x-2)$$

$$6x-4$$

$$30x+18$$

$$-6x+4$$


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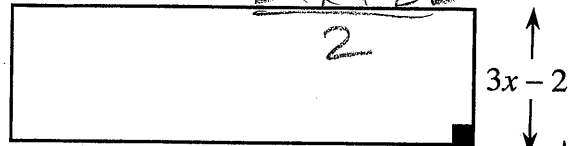

$$24x+22$$

4 The perimeter of the rectangular room on the right is  $(30x + 18)$  metres.

The width is  $(3x - 2)$  metres.

Logan wants to install a carpet that covers the entire floor.

**How many square metres of carpet are needed to cover the floor?**



$$12x+11$$

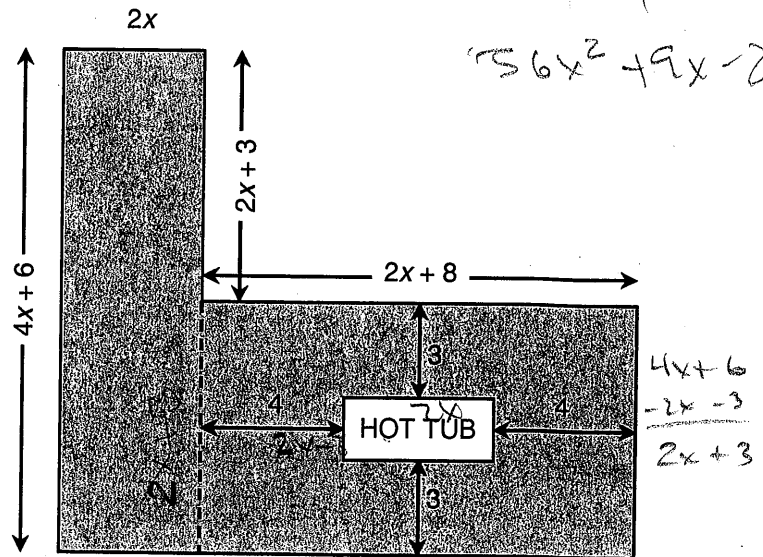
$3x$	$-2$
$12x$	$36x^2 - 24x$
$11$	$33x - 22$

$$36x^2 + 9x - 22$$

5 The floor of a wooden deck is designed such that there is a space set aside for a HOT TUB.

The diagram at the right shows the dimensions of the deck, and the hot tub is represented by the non-shaded rectangle.

**What is the algebraic expression for the area of the wooden portion of the deck?**



$$4x+6$$

$$-2x-3$$


---


$$2x+3$$

$2x$	$3$
$2x$	$6x$
$8$	$24$

$$4x^2 + 22x + 24$$

$$2x(4x+6) + (2x+3)(2x+8)$$

$$- 2x(2x+3)$$

$$8x^2 + 12x + 4x^2 + 22x + 24 - 4x^2 + 6x$$

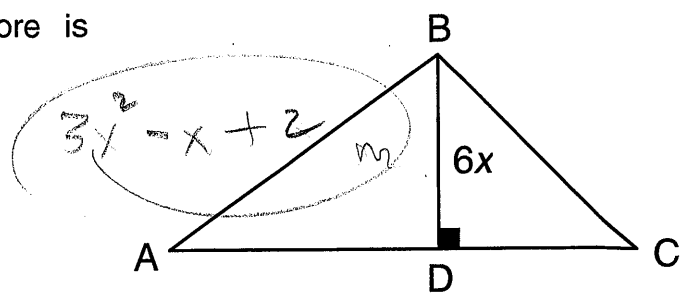
$$8x^2 + 40x + 24$$

$$\frac{9x^3 - 3x^2 + 6x^2}{3x} = \frac{9x^3 + 3x^2}{3x} = 3x^2 + x$$

6 The triangular logo of a video store is shown on the right.

The height is  $(6x)$  m.

Its area is  $(9x^3 - 3x^2 + 6x)$  m<sup>2</sup>.

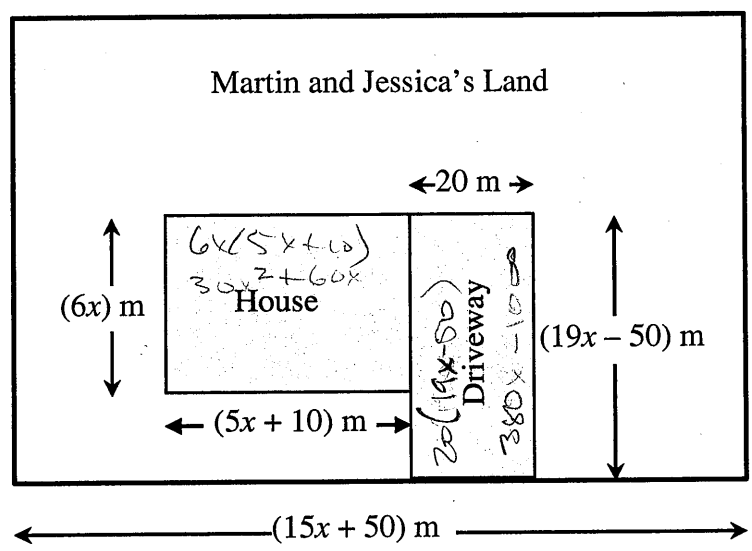


What simplified algebraic expression represents the base of the logo?

7 Martin and Jessica are building a house. They want to seed the land around the house and driveway with grass.

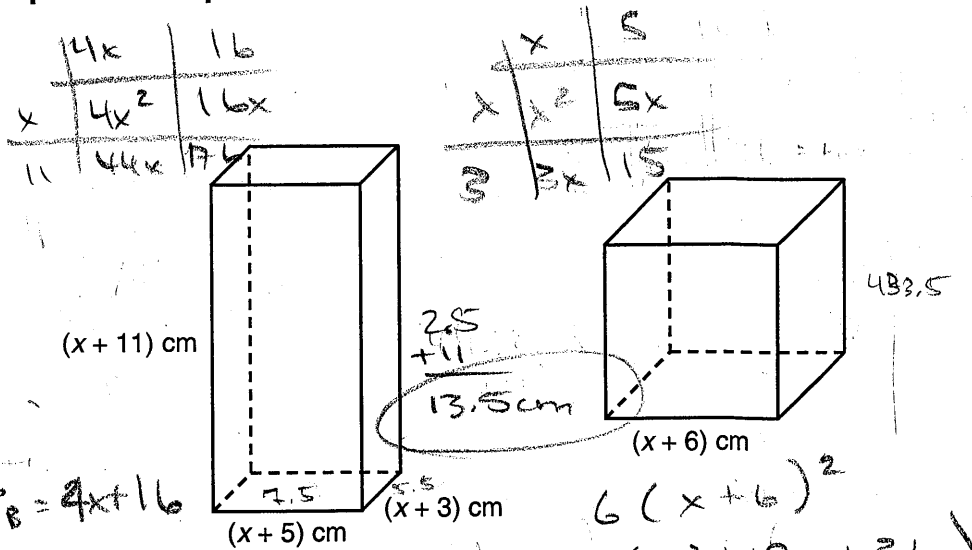
$$\begin{array}{r} 20x - 20 \\ \hline 300x^2 - 300x \\ \hline 1000x - 1000 \end{array} \quad (20x - 20) \text{ m}$$

$$\begin{array}{r} 300x^2 + 700x + 1000 \\ - 30x^2 - 60x \\ \hline 270x^2 + 260x + 1000 \end{array}$$



What simplified algebraic expression represents the total surface area of the land available for seeding?

8 A rectangular right prism and a cube have the same total surface area. The dimensions are shown in the diagram on the right.



What is the numerical value of the height of the prism?

$$A_T = 2(4x+16)(x+11) + 2(x+5)(x+3) + 2(x+5)(x+3)$$

$$4x^2 + 60x + 176 + 2(x^2 + 8x + 15)$$

$$4x^2 + 60x + 176 + 2x^2 + 16x + 30$$

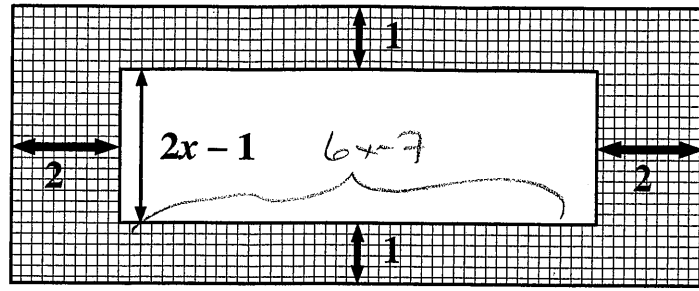
$$6x^2 + 76x + 206$$

$$A_T = 6(x+6)^2 = 6(x^2 + 12x + 36) = 6x^2 + 72x + 216$$

$$4x = 10 \implies x = 2.5$$

9 What is the simplified algebraic expression for the area of the tiled region?

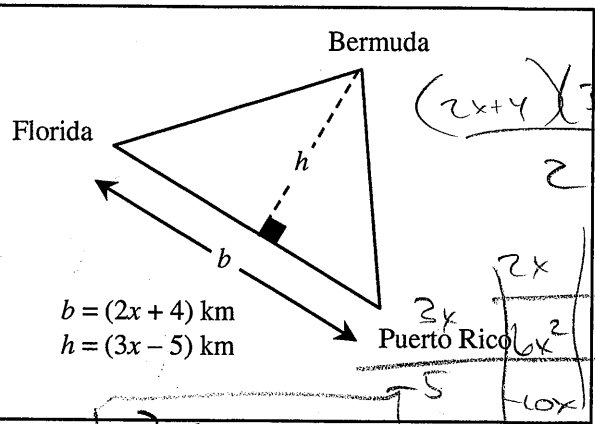
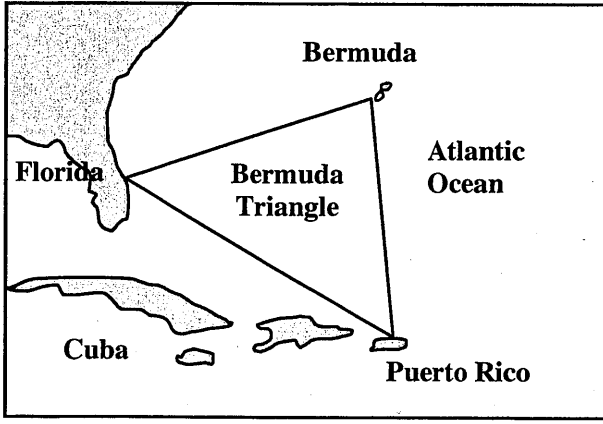
$$\begin{array}{r} 6x \overline{) 12x^2 - 6x} \\ \underline{12x^2} \phantom{- 6x} \\ 6x - 3 \phantom{0} \\ \underline{6x - 3} \\ 0 \end{array}$$



$$\begin{array}{r} 2x \overline{) 12x^2 - 6x} \\ \underline{12x^2} \phantom{- 6x} \\ 6x - 3 \phantom{0} \\ \underline{6x - 3} \\ 0 \end{array}$$

$$\begin{array}{r} 2x \overline{) 12x^2 - 6x} \\ \underline{12x^2} \phantom{- 6x} \\ 6x - 3 \phantom{0} \\ \underline{6x - 3} \\ 0 \end{array}$$

10 What algebraic expression represents the region occupied by the Bermuda Triangle?



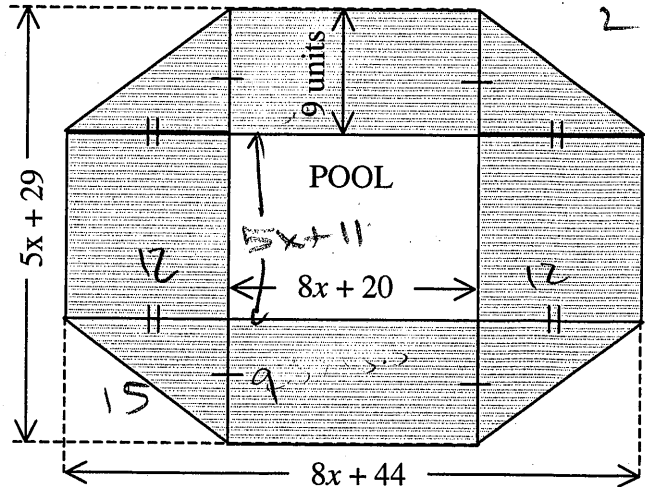
$b = (2x + 4)$  km  
 $h = (3x - 5)$  km

$$\begin{array}{r} 2x \overline{) 12x^2 - 6x} \\ \underline{12x^2} \phantom{- 6x} \\ 6x - 3 \phantom{0} \\ \underline{6x - 3} \\ 0 \end{array}$$

$3x^2 + x - 10$

11 The floor of a wooden deck is designed around a rectangular pool as shown. The deck is the shaded area.

What is the simplified algebraic expression for the length of fencing that will be required around the outer perimeter of the deck?



$$\begin{array}{r} 2(12(2.5x + 5.5)) \\ 24(2.5x + 5.5) \\ 60x + 132 \end{array}$$

$$\begin{array}{r} 5x + 29 \\ - 9 \\ \hline 5x + 11 \end{array}$$

$$\begin{array}{r} 4(15) + 2(8x + 20) + 2(5x + 11) \\ 60 + 16x + 40 + 10x + 22 \\ \hline 26x + 122 \end{array}$$

# Linear Functions

1. To purchase a licence to hold a lottery, you pay a fixed amount plus a certain percentage of the total value of the tickets printed.

Total value of the tickets printed	Licensing Fee
\$2000	\$85
\$5000	\$175
\$12 000	\$385

$$\frac{175 - 85}{5000 - 2000} = \frac{90}{3000} = 0.03$$

An organization spent \$265 to obtain a licence.

What was the total value of the tickets printed?

\$8000

$$175 = 0.03(5000) + b$$

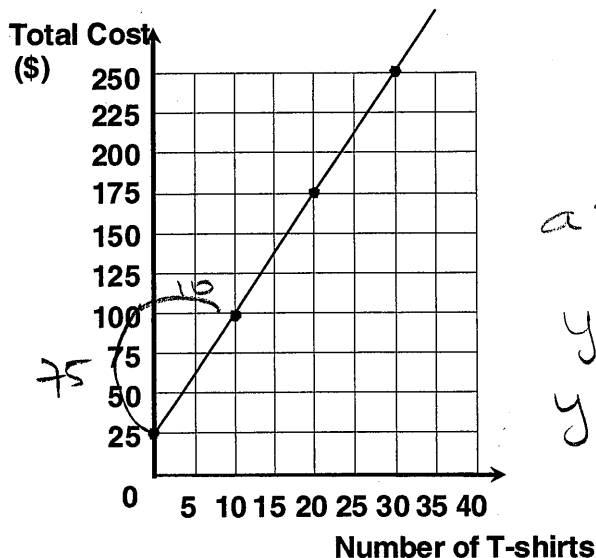
$$b = 25$$

$$y = 0.03x + 25$$

$$265 = 0.03x + 25$$

2. The graph represents the cost of ordering T-shirts from a printing company. A delivery fee of \$25 is included in the cost.

How much does it cost to purchase 125 T-shirts from this company?



$$a = \frac{75}{10} = 7.5$$

$$y = 7.5x + 25$$

$$y = 7.5(125) + 25$$

$$\$962.50$$

3. The members of a certain tennis club have to buy an annual membership card. In addition, they must pay a fixed hourly rate to rent a tennis court.

Paul, Kelly, and Lana all belong to this club. Paul spent \$47<sup>y<sub>1</sub></sup> for his membership card and 20 hours of court time. Kelly paid \$106.80<sup>y<sub>2</sub></sup> for her membership card and 72 hours of court time.

How much will it cost Lana for her membership card and 45 hours of court time?

$$\frac{72 - 20}{106.8 - 47} = \frac{52}{59.8} = \$0.87/h$$

$$106.8 = 72(0.87) + b$$

$$62.64$$

$$44.16 = b$$

$$y = 0.87x + 44.16$$

$$(45)$$

$$\$83.31$$

# Linear Functions

4. An insurance agent's weekly salary is determined by adding a percentage of the total amount of his sales for the week to his basic salary.

Weekly Salary Based on the Total Amount of Sales for the Week	
Amount of sales (\$)	Weekly salary (\$)
$x_1$ 1000	$y_1$ 300
$x_2$ 1500	$y_2$ 350
3000	500
5000	700
8500	1050

$$\frac{350 - 300}{1500 - 1000} = \frac{50}{500} = 0.1$$

Given this information, what salary would this agent receive if his sales total \$6000 for the week?

\$500

$$y = 0.1x + 200$$

$$y = 0.1(6000) + 200$$

5. A cross-country ski club offers skiers two payment options.  
 Option 1: An annual membership fee of \$30 and a \$5 fee for each day skiing on the trail.

$$y = 5x + 30$$

$$350 = 0.1(1500) + b$$

$$350 = 150 + b$$

$$b = 200$$

Option 2: No annual membership fee, but a set fee for each day skiing on the trail.

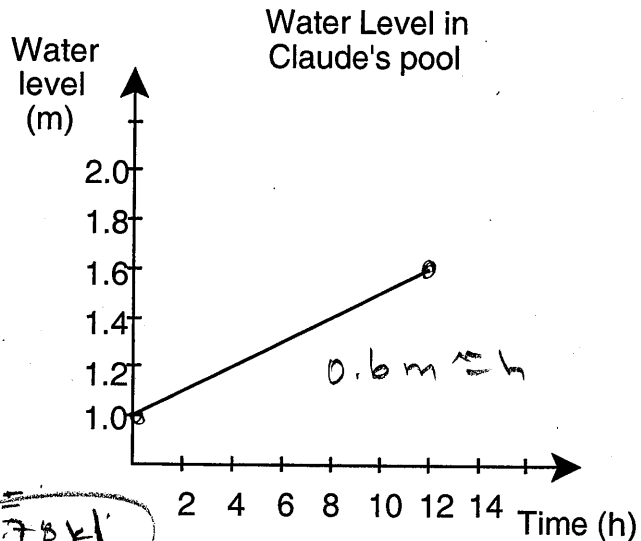
Andy, who chose the first payment option, paid \$105 for the season. Sonia chose the second option. She skied as many days as Andy did, and paid the same amount. **What is the set price per day with the second payment option?**

$$105 = 5x + 30$$

$$x = 15 \text{ days}$$

$$\frac{105}{15} = 7 \text{ days}$$

6. Claude added water to his circular pool whose diameter is 5 m. It took 12 hours to complete the task.



$$d = 5$$

$$r = 2.5$$

$$\pi r^2 \cdot h$$

$$\pi (2.5)^2 \cdot 0.6$$

$$11.78 \text{ m}^3 = 11.78 \text{ kl}$$

**How many kilolitres of water did Claude add to his pool?**

$$\frac{1 \text{ m}^3}{1000} = 1 \text{ kl}$$

$$1 \text{ dm}^3 = 1 \text{ l}$$



# Linear Functions

7. The weekly salaries of three workers are calculated as follows:

Alan's salary

$$S = 22h + 100$$

where  $S$ : weekly salary in \$

$h$ : number of hours of work

$$980 = 22(40) + 100$$

Josée's salary

A basic salary of \$80, plus \$18 per hour

$$y = 18x + 80$$

$$780 = 18x + 80 = 80 \text{ hours}$$

Jack's salary

Time (hours)	0	10	20	30	40
Salary (\$)	0	200	400	600	800

$$y = 20x$$

49 hours

One week, Alan worked 40 hours. Josée and Jack earned the same amount of money as Alan did that week.

**How many more hours did Josée work than Jack that particular week?**

1 hour

8. Roger is an electrician. He charges a basic hourly rate plus a \$20 fee for travelling. Last Saturday, Roger worked for 5 hours at his nephew's house. Because he is a relative, Roger decided not to charge his nephew for travelling and he also reduced his hourly rate to \$12 an hour.

$$220 = a(5) + 20$$

$$a = \$40/\text{hour}$$

If Roger had charged his nephew full price, the total bill would have been \$220.

**By what amount did Roger decrease his regular hourly rate for his nephew?**

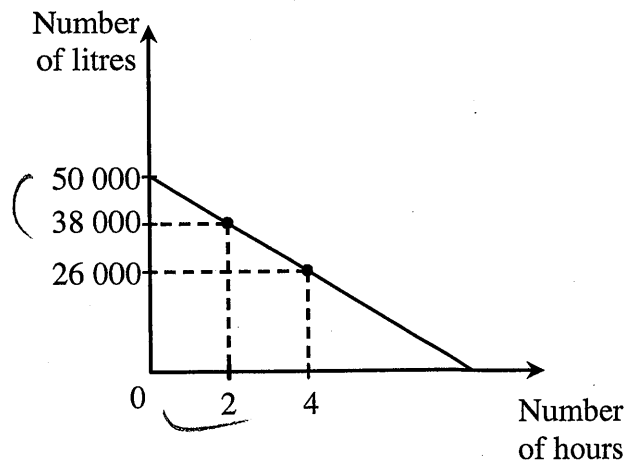
\$28/h

9. Jossia's pool holds 50 000L of water.

The pool developed a leak.

After 2 hours, 38 000L of water remain in the pool, while after 4 hours, 26 000L remain.

**How many litres of water remain in the pool after 7 hours?**



$$\frac{12000}{2} = 6000 \text{ L/hour}$$

$$y = -6000x + 50000$$

$$y = -6000(7) + 50000$$

$$y = 8000 \text{ L}$$