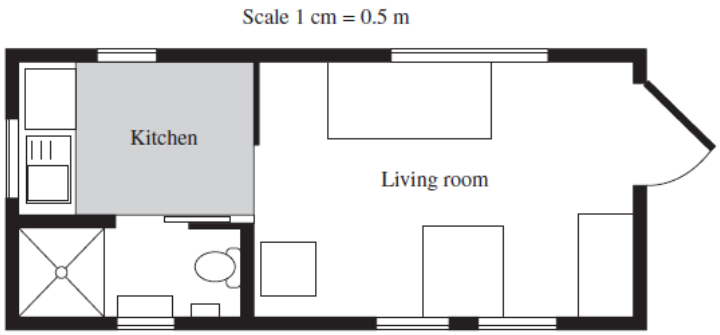
M5: Scale Drawings

Triangle I and Triangle II are similar. Pairs of equal angles are shown.

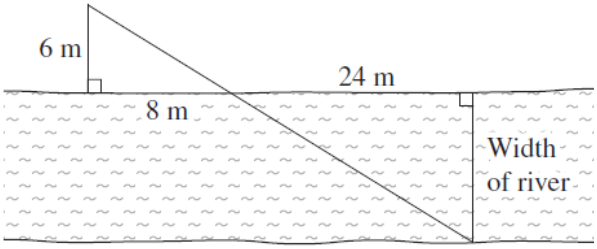
What is the area of Triangle II?
A. 18 cm^2 B. 24 cm^2 C. 30 cm^2 D. 48 cm^2

The plan of the lower level of a small house is shown.
(a) How many windows are shown on the plan?
(b) What is the actual perimeter, in metres, of the shaded part of the kitchen floor?



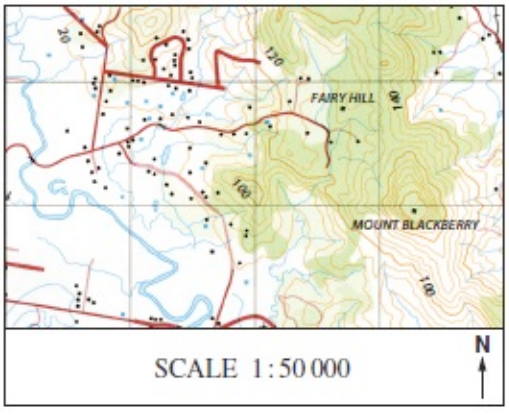
There are 10 boys in a class of 25 students.
What is the ratio of boys to girls in the class?
A. 2:3 B. 2:5 C. 3:2 D. 5:2

Similar triangles can be used to estimate the width of a river, as shown in the diagram.
What is the estimated width of the river?
A. 18 m B. 22 m
C. 26 m D. 32 m

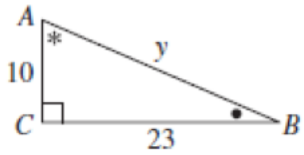


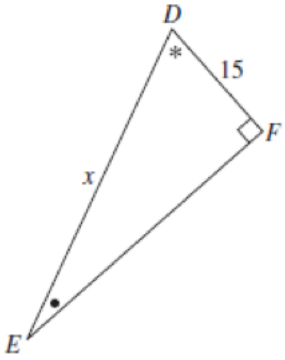
Part of a map is shown.
(a) What is the actual distance between Mount Blackberry and Fairy Hill, in kilometres?

(b) Two bridges, not shown on this part of the map, are 7.5 km apart. How far apart on the map would be the two bridges be, in centimetres?



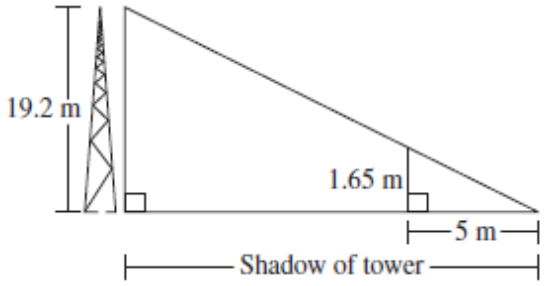
Triangles *ABC* and *DEF* are similar. Find the value of *x*





At a particular time during the day, a tower of height 19.2 metres casts a shadow. At the same time, a person who is 1.65 metres tall casts a shadow 5 metres long.
What is the length of the shadow cast by the tower at that time?

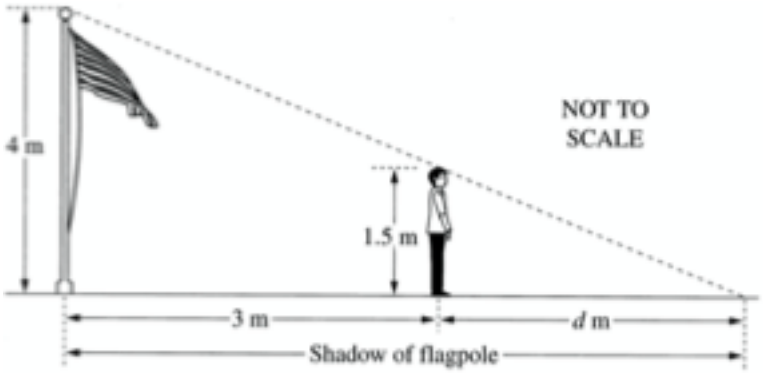
NOT TO SCALE



Joel mixes petrol and oil in the ratio 40:1 to make fuel for his leaf blower.
(i) Joel pours 5 litres of petrol into an empty container to make fuel for his leaf blower. How much oil should he add to the petrol to ensure that the fuel is in the correct ratio?
(ii) Joel has 4.1 litres of fuel left in his container after filling his leaf blower. He wishes to use this fuel in his lawnmower. However, his lawnmower requires the petrol and oil to be mixed in the ratio 25 :1.
How much oil should he add to the container so that the fuel is in the correct ratio for his lawnmower?

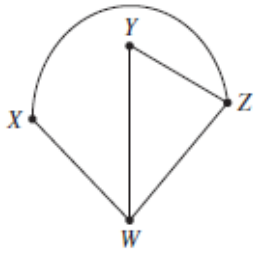
A map has a scale of 1:500 000.
(i) Two mountain peaks are 2 cm apart on the map. What is the actual distance between the two mountain peaks, in kilometres?
(ii) Two cities are 75 km apart.
How far apart are the two cities on the map, in centimetres?

Joe and a flagpole both cast shadows on the ground.
The difference between the lengths of their shadows is 3 metres.
The length of Jacques' shadow is *d* metres.



N1: Networks

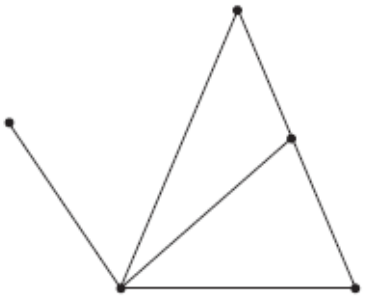
A network diagram is given
What is the degree of vertex W?
A. 1
B. 2
C. 3
D. 4



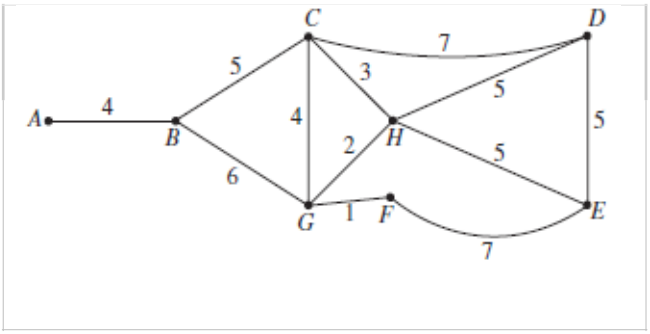
A regional airline operates flights in Queensland.
Flight times between connected towns are shown in the table.
Draw a network diagram to show how the towns are connected, with weights on the edges showing the flight times.

	Cairns	*Kowanyama*	*Mt Isa*	*Pormpuraaw*	*Townsville*
Cairns	–	1 h 50 min	2 h 5 min	–	55 min
Kowanyama	1 h 50 min	–	–	20 min	–
Mt Isa	2 h 5 min	–	–	–	1 h 40 min
Pormpuraaw	–	20 min	–	–	–
Townsville	55 min	–	1 h 40 min	–	–

The diagram shows a network.
What is the sum of the degrees of the vertices in this network?
A. 5
B. 10
C. 11
D. 12



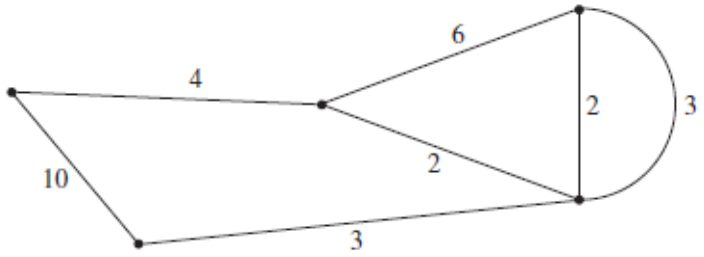
The network diagram shows the tracks connecting 8 picnic sites in a nature park. The vertices *A* to *H* represents the picnic sites. The weights on the edges represent the distances along the tracks between the picnic sites, in kilometres.
(a) Each picnic site needs to provide drinking water. The main water source is at site *A*. By drawing a minimum spanning tree in the space below, calculate the minimum length of water pipes required to supply water to all the sites if the water pipes can only be laid along the tracks.
(b) One day the track between *C* and *H* is closed. State the vertices that identify the shortest path from *C* to *E* that avoids the closed track.



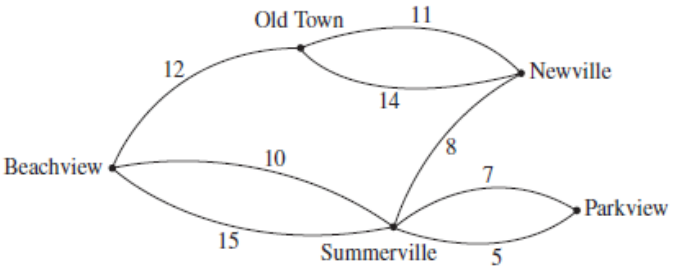
In a town, there are four petrol stations *W*, *X*, *Y* and *Z*. The table shows the length, in metres, of roads connecting these petrol stations.
A petrol tanker needs to visit each station.
What is the shortest distance it can travel if it starts at Station *W*?
A. 840 m B. 1000 m
C. 1120 m D. 1270 m

	W	*X*	*Y*	*Z*
W	–	650	–	280
X	650	–	500	220
Y	–	500	–	340
Z	280	220	340	–

A weighted network diagram is shown here.
What is the weight of the minimum spanning tree?
A. 10
B. 11
C. 12
D. 14



This diagram shows the possible paths (in km) for laying gas pipes between various locations. Gas is to be supplied from one location. Any one of the locations can be the source of the supply. What is the minimum length of the pipes required to provide gas to all locations?
A. 32 km B. 34 km
C. 36 km D. 38 km



In a town, there are four petrol stations *W*, *X*, *Y* and *Z*. The table shows the length, in metres, of roads connecting these petrol stations.
(a) Construct a network diagram to represent the information in the table.
(b) A petrol tanker needs to visit each station. Calculate the shortest distance that can be travelled by the petrol tanker. In your answer, include the order that the petrol stations are refilled.

	W	*X*	*Y*	*Z*
W	–	650	–	280
X	650	–	500	220
Y	–	500	–	340
Z	280	220	340	–

F2: Interest

What amount must be invested now at 4% per annum, compounded quarterly, so that in five years it will have grown to $60 000?
A. $8919 B. $11 156 C. $49 173 D. $49 316

Mia wants to invest $42 000 for a total of 5 years. She has three investment options.
Option A – simple interest is paid at the rate of 6% per annum
Option B – compound interest is paid at a rate of 5.5% per annum, compounded annually
Option C – compound interest is paid at a rate of 4.8% per annum, compounded quarterly
Determine Mia's best investment option. Support your answer with calculations.

A teacher bought 2500 shares in a business two years ago at $5.25 a share.
The share price of the business has increased by 36%.
Calculate the increase in the value of the investment.

A house was purchased at the start of 1986 for $45 000.
Assume that the value of the house has increased by 8% per annum since then.
What is the value of the house at the end of 2019, to the nearest $1000?

A single amount of $10 000 is invested for 4 years, earning interest at the rate of 3% per annum, compounded monthly.
Calculate the future value of the investment.

The table shows the compounded values of $1 at different interest rates over different periods. Amy hopes to have $21 000 in 2 years to buy a car. She opens an account today which pays interest of 4% pa. compounded quarterly. Using the table, which expression calculates the minimum single sum that Amy needs to invest today to ensure she reaches her savings goal?
A. 21 000 × 1.0816
B. 21 000 ÷ 1.0816
C. 21 000 × 1.0829

Compounded values of $1

Number of periods	*Interest rate per period*				
	1%	2%	3%	4%	5%
2	1.0201	1.0404	1.0609	1.0816	1.1025
4	1.0406	1.0824	1.1255	1.1699	1.2155
6	1.0615	1.1262	1.1941	1.2653	1.3401
8	1.0829	1.1717	1.2668	1.3686	1.4775
10	1.1046	1.2190	1.3439	1.4802	1.6289
12	1.1268	1.2682	1.4258	1.6010	1.7959

A family currently pays $320 for some groceries. Assuming a constant annual inflation rate of 2.9%, calculate how much would be paid for the same groceries in 5 years time.

Bill and Ted plan to have $20 000 in an investment account in 15 years time for their grandchild's university fees. The interest rate for the investment account will be fixed at 3% per annum compounded monthly. Calculate the amount they will need to deposit into the account now in order to achieve their plan.

What amount must be invested now at 4% per annum, compounded quarterly, so that in five years it will have grown to $60 000?

F3: Depreciation and Loans

Elyse borrowed $6000 from a bank.
She repaid the loan in full with payments of $200 every month for 3 years.
How much interest did Elyse pay to the bank?

A new car is bought for $24 950.
Each year the value of the car depreciates by 14%.
Using the declining-balance method, calculate the salvage value of the car at the end of 10 years.

Ashley has a credit card with the following conditions:

- There is no interest-free period
- Interest is charged at the end of each month at 18.25% per annum, compounded daily, from the purchase date (included) to the last day of the month (included).

Ashley's credit card statement for April is shown, with some figures missing.
The minimum payment is calculated as 2% of the closing balance on 30 April.
Calculate the minimum payment.

Statement period: 1 April to 30 April

Date	Details	Amount ($)
1 April	Opening balance	0
20 April	Furniture	3700
30 April	Interest charged	***
30 April	Closing balance	***

Minimum payment: _____

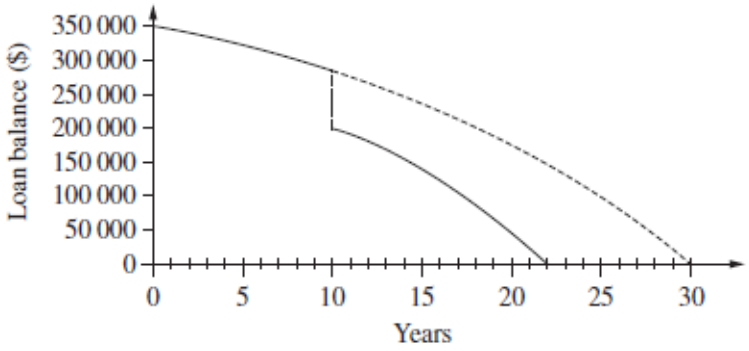
A sum of $250 000 was borrowed to buy a house. The interest rate and monthly repayment for the loan are shown in the spreadsheet.
What is the total interest charged for the first four months of this loan?
A. $6364.32
B. $6366.11
C. $6369.67
D. $6376.25

	A	B	C	D	E
1	**Home Loan Table**			*This table assumes the same number of days in each month, ie*	
2		Amount = $250 000		Interest = Rate/12 × Principal	
3		Annual Interest Rate = 7.65%			
4		Monthly Repayment (*R*) = $1871.94			
5					
6	**Month**	**Principal (*P*)**	**Interest (*I*)**	***P* + *I***	***P* + *I* − *R***
7	1	$250 000.00	$1593.75	$251 593.75	$249 721.81
8	2	$249 721.81	$1591.98	$251 313.79	$249 441.85
9	3	$249 441.85	$1590.19	$251 032.04	
10	4				

Sheet 1 Sheet 2

Jay bought a computer for $3600. His friend Julie says that all computers are worth nothing (ie the value is $0) after 3 years.
(a) Assume that Julie is correct. Find the amount that the computer would be worth after 2 years, if the straight-line method of depreciation is used.
(b) Explain why the computer would never be worth nothing if the declining-balance method of depreciation is used, with a 30% per annum rate of depreciation.
Use suitable calculations to support your answer.

An electrician borrowed $350 000 to be repaid over 30 years, with monthly repayments of $1880. However, after 10 years he made a lump sum payment of $80 000. The monthly repayment remained unchanged. The graph shows the balances owing over the period of the loan.
Using information from the graph, calculate how much less the electrician paid over the period of the loan by making the lump sum payment.



A car is purchased for $23 900. The value of the car is depreciated by 11.5% each year using the declining-balance method. What is the value of the car after three years?

Andrew borrowed $20 000 to be repaid in equal monthly repayments of $243 over 10 years. Having made this monthly repayment for 4 years, he increased his monthly repayment to $281. As a result, Andrew paid off the loan one year earlier. How much less did he repay altogether by making this change?

Yanika opens a new credit card account, with interest and fees as shown.
Yanika makes a single purchase of $849 with the credit card.
(i) Show that the balance owing on the credit card 24 days after making the purchase is $855.87.
(ii) Yanika makes her first repayment 24 days after making the purchase. She makes a cash repayment of $450. What is the balance owing on the credit card immediately after her repayment is made and the repayment fee has been charged?

Interest
- Flat rate of 12.3% per annum
- No interest-free period

Fees
- $0 for online repayments
- $3 for repayments in cash

(fee added to balance immediately after repayment)

A new car was bought for $19 900 and one year later its value had depreciated to $16 300. What is the approximate depreciation, expressed as a percentage of the purchase price?
(A) 18% (B) 22% (C) 78% (D) 82%

Rachel bought a motorcycle advertised for $7990. She paid a deposit a $500 deposit and took out a flat-rate loan to repay the balance. Simple interest was charged at a rate of 7% per annum on the amount borrowed. She repaid the loan over 2 years, making equal weekly repayments. Calculate the weekly repayment.

Marge borrowed $19 000 to buy a used car. Interest on the loan was charged at 4.8% pa at the end of each month. She made a repayment of $436 at the end of every month. The table below sets out her monthly repayment schedule for the first four months of the loan.
(i) Some values in the table are missing. Write down the values for *A* and *B*.
(ii) Calculate the value of *X*.
(iii) Marge repaid this loan over four years. What is the total amount that Marge repaid?

Month	*Amount owing at start of month*	*Interest charged*	*Repayment*	*Amount owing at end of month*
1	*A*	$76.00	$436.00	$18 640.00
2	$18 640.00	*X*	$436.00	$18 278.56
3	$18 278.56	$73.11	$436.00	$17 915.67
4	$17 915.67	$71.66	$436.00	*B*

On 20 August, tickets were purchased for $425 using a credit card. No other purchases were made using this card in August. Simple interest was charged at a rate of 18.4% per annum. There was no interest-free period. The period for which interest was charged included the date of purchase and the date of payment. What amount was paid when the account was paid in full on 31 August?

A television was purchased for $2100 on 12 April 2011 using a credit card. Simple interest was charged at a rate of 19.74% per annum for purchases on this credit card. There were no other purchases on the credit card account. There was no interest-free period. The payment for which interest was charged included the date purchased and the date of payment. What amount was paid when the account was paid in full on 20 May 2011?
(A) $2143.16 (B) $2143.59 (C) $2144.29 (D) $2144.74