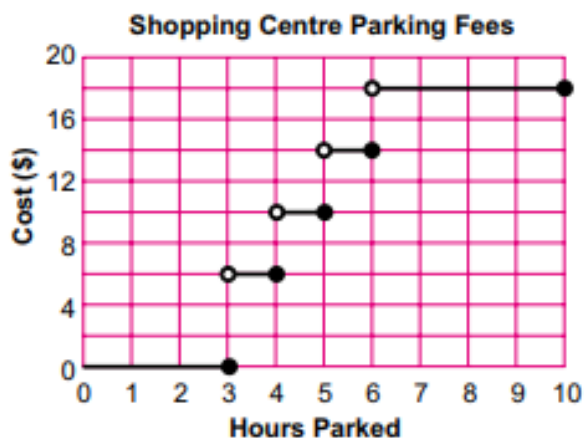


Goals

Your exam is on:

Thursday 16th November at 11:15am – 1:15pm in the gym



This week we are going to:

- sketch piece-wise linear graphs and step graphs, using technology when appropriate
- interpret piece-wise linear and step graphs used to model practical situations; for example, the tax paid as income increases, the change in the level of water in a tank over time when water is drawn off at different intervals and for different periods of time, the charging scheme for sending parcels of different weights through the post

Theoretical Components

Resources:

PDF file: Week 15 Notes and Exercises

The clip below explains step graphs:

<https://www.youtube.com/watch?v=LUshzsvogZU>

Revision Checklist

- Non-right angled triangles
 - Sine rule
 - Cosine rule
 - Area – 3 methods
- Applications of trigonometry
 - Bearings and navigation
- Solving linear equations
- Properties of linear equations
- Analysing linear graphs
- Solving simultaneous equations
- Step graphs and their applications

Order

1. Read through the notes and examples
2. Work through the exercises
3. Complete the investigation at the end of the booklet.
4. Complete the reflection at the end of the booklet
5. Come and see your teacher and make sure you are up to date.

Practical Components

Go through your folders and complete any missing tasks and review any questions that are incorrect.

GET YOUR OWN CALCULATOR!!!

Your classwork, investigations and in-class task (weeks 9 – 15) make up 20% of your grade for this semester.

Make sure you have handed in any unsubmitted work before the exam. This will allow your teacher to provide some feedback prior to the exam (and boost your marks).

Investigation

Prepare your double-sided A4 page of handwritten summary notes.

The exam will cover all work from weeks 9 – 15. It is worth 30% of your grade for this semester.

QFO

Quiz this Monday!

Checklist: Are you up to date with your briefs this semester?

Brief: topic/work covered	Rules and formulae; worked examples / reminders
Week 9/10: Trigonometry Score: /20	
Week 11: Linear equations Score: /20	
Week 12: Straight line graphs Score: /20	
Week 13/14: Simultaneous equations Score: /20	
Week 15: Step graphs In-class quiz Score: /20	
TOTAL Score: /100	<p align="center">%</p>

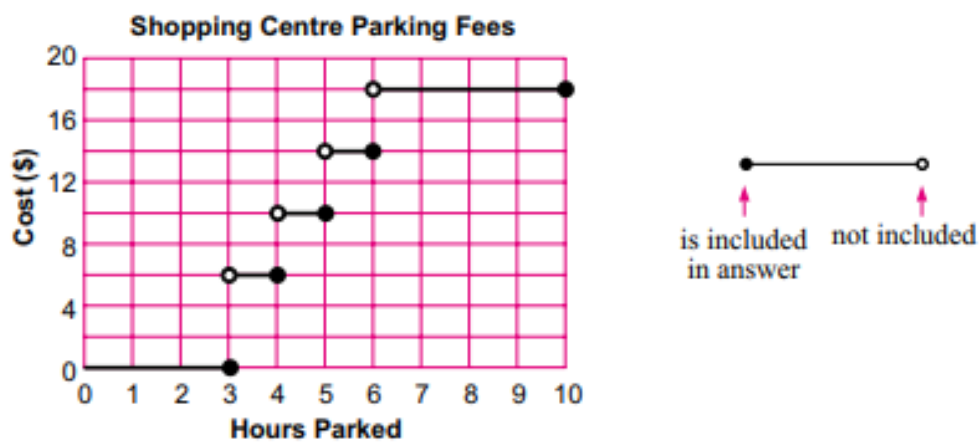
MATHEMATICAL APPLICATIONS 2

WEEK 15 NOTES & EXERCISES

STEP AND PIECEWISE GRAPHS

A step graph is another type of linear function. It looks like a series of steps.

Example



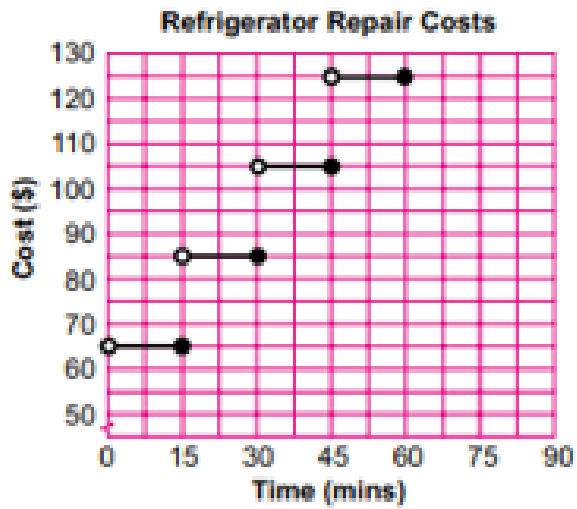
- a** Find the cost of parking for
- i** $2\frac{1}{2}$ hrs **ii** 3 hrs **iii** $3\frac{1}{2}$ hrs **iv** 5 hrs **v** 5 hrs 10 mins.
- b** What is the maximum time a car can park for
- i** \$10 **ii** \$14 **iii** \$18?
- c** What is the range in time which a car can park for a cost of
- i** \$0 **ii** \$18 **iii** \$6?

Solutions

- a** **i** \$0 **ii** \$0 **iii** \$6 **iv** \$10 **v** \$14
- b** **i** 5 hrs **ii** 6 hrs **iii** 10 hrs
- c** **i** 0 - 3 hours.
ii More than 6 hours and up to and including 10 hours.
iii More than 3 hours and up to and including 4 hours.

EXERCISE 1

1.



a) From the graph, find the cost of a service which takes:

(i) 35 min

(ii) 12 min

(iii) 46 min

b) What is the maximum length of service costing:

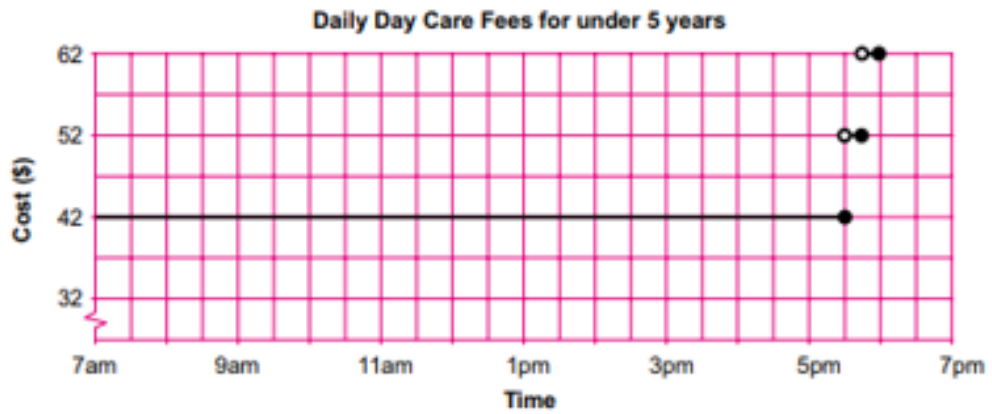
(i) \$65

(ii) \$85

(iii) \$125

c) What is the minimum cost of a callout?

2.



a) What is the regular daily fee for child care?

b) What is the daily fee if a child is picked up between 5:00 and 5:30 pm?

c) What is the late fee charged for a child picked up after 5:30 pm?

d) In a particular week, Louise collects her toddler from the day care centre at these times;

5 pm, 5:30 pm, 4 pm, 5:45 pm, 6 pm.

How much does Louise pay in day care fees for this week?

3. Draw a step graph to represent this information.

BOBCAT HIRE	
<i>Hire Time</i>	<i>Fee</i>
4 hours or less	\$200
for each hour or part thereof after 4 hours	\$50
8 hours or more	\$500

REVISION

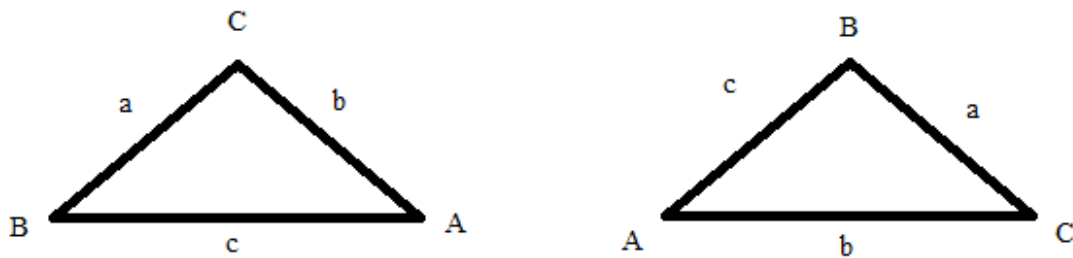
When dealing with right angled triangles, we can use the SOH CAH TOA rules to find unknown sides, depending on what sides and angles we are given.

- 1)
 - a) When the sides we are given/want to find are the opposite and the hypotenuse, we use _____
 - b) When the sides we are given/want to find are the _____ and the hypotenuse, we use Cosine.
 - c) When the sides we are given/want to find are the _____ and adjacent, we use Tangent.

- 2) Complete the following table to have all the formulas you will need to use SOH CAH TOA rules.

SINE	COSINE	TANGENT
$\sin \theta = \frac{\text{opp}}{\text{hyp}}$	$\cos \theta = \frac{\text{adj}}{\text{hyp}}$	$\tan \theta = \frac{\text{opp}}{\text{adj}}$
_____ = $\text{hyp} \times \sin \theta$	$\text{adj} = \text{hyp} \times$ _____	$\text{opp} =$ _____ $\times \tan \theta$
$\text{hyp} = \text{opp} \div \sin \theta$	_____ = $\text{adj} \div \cos \theta$	$\text{adj} = \text{opp} \div$ _____

When using the Sine or Cosine rule, we can label whichever sides we want as 'a' 'b' or 'c', as long as we make the corresponding opposite angles 'A', 'B', and 'C'. For example, side 'a' will be opposite angle 'A'.



We use the Sine rule when we have the values for a matching side and angle, and the angle/side opposite the unknown.

3) The formula is:

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

or

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

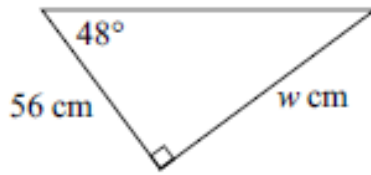
4) We use the Cosine rule when we have two sides and the _____ between them.

The formula is $c^2 = a^2 + b^2 - 2ab * \cos(C)$

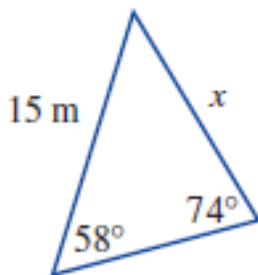
5) We can also use the Cosine rule to find any angle when we have all three _____.

The formula is $\cos(C) = \frac{a^2+b^2-c^2}{2ab}$

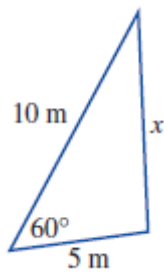
a) Find the length of the unknown side of the following triangle.



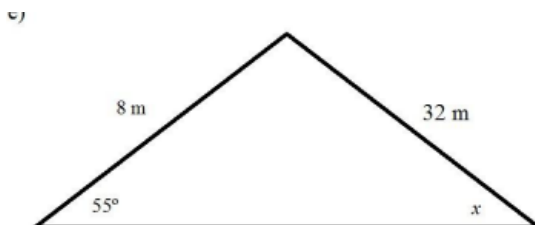
b) Find the length of the unknown side of the following triangle.



c) Find the length of the unknown side of the following triangle.



d) Find the length of the unknown angles in the following triangle.



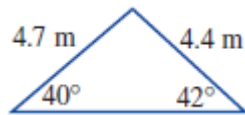
6) There are three formulas for the area of a triangle:

a) Area = _____

b) Area = $\frac{1}{2} * ab * \sin C$

c) $Area_{triangle} = \sqrt{s(s-a)(s-b)(s-c)}$ where the semi-perimeter, $s = \frac{(a+b+c)}{2}$.

Find the area of the following triangle:



7) a) Non-standard compass bearings typically involve determining how far East or West a direction is angled from _____ or _____

a) N45W means that the direction is _____ degrees West from North.

b) True bearings simply determine the angle the direction is made from the _____ direction.

c) We can determine the direction of 252°T by checking which angle values it is between. Since it is more than 180 degrees from North, but less than 270, we can tell that it is pointing in the _____ quadrant.

When solving linear equations we need to rearrange the equation to make the variable the subject. For example, we need to make the equation:

$$2x + 3 = 6 \text{ into an equation that begins with } x =$$

Fill in the blanks below to rearrange the equation.

8) $2x + 3 = 6$

$$2x = 6 \text{ _____}$$

$$2x/2 = 3/ \underline{\hspace{1cm}}$$

$$x =$$

9) We can also rearrange equations with multiple variables to find it in terms of one of the variables. For example we can rearrange:

$$2y + x = 3 \text{ to get } \underline{\hspace{1cm}} = 3 - 2y$$

10) The general formula for a linear equation is $y = mx + b$ where m is the _____ and _____ is the y intercept.

11) To find the value of the gradient, choose two points on the graph, and use them to find how much the line rises compared to how much it runs. For example, if the line rises by 6, and runs by 3, the gradient would be _____.

12) To find the y intercept, we need to find the value of y when the line passes through the _____. In other words, what value of y do we get when we set x to 0?

13) When two lines intersect, that is the point when the x and y values of those two equations are _____ to each other.

14) Jeanette is comparing the plans of two telephone companies providing long distance calls. OzExpress One has a monthly access fee of \$8 and charges \$0.70 per call, while Optel Easy has a monthly access fee of \$10 and charges \$0.50 per call. The costs C of these plans can be represented by the following formulas, where n is the number of phone calls made during the month:

$$\text{OzExpress One } C = 0.7n + 8$$

$$\text{Optel Easy } C = 0.5n + 10$$

a) Graph both formulas on the same axes for values of n from 0 to 20.

b) For what number of calls per month do both plans charge the same cost? Verify your answer by solving using the substitution or elimination method.

c) To what type of caller would you recommend:

(i) the OzExpress One plan?

(ii) the Optel Easy plan?

d) If Jeanette usually makes 8 long distance calls per month, which plan is the better one for her?