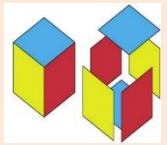
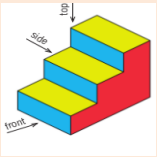
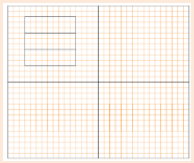
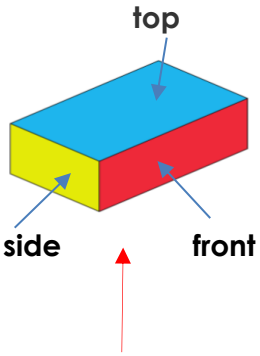
GRADE	9	TERM	1	WEEK	2 & 3	
Role Players (WHO is going to teach/ guide/ support…)	**Aim/ Purpose/ Topic/ Content/ Concepts/ Skills (WHAT am I going to teach/ guide/ support…)**	**Teaching Methodologies & Classroom Management Skills (HOW am I going to teach/ guide/ support…)**			**Resources/ LTSM (WHAT am I going to use to teach/ guide/ support…)**	
					Paper-based Resources	**Digital Resources**
 **TEACHERS & PARENTS**	**Design skills** **First angle orthographic projection:** Three-dimensional objects on flat paper **Concept of drawing three different views**: front, top and side. Simple cubes. **Line types**: dark, feint, dashed, wavy, chain. Scale and dimensions **More complex 3D objects:** with instruments, drawn in orthographic projection. **Design problem:** Flight of stairs and wheelchair ramp	Explanation Explanation of instructions and mediating concepts of: - **Design skills** Explanation of instructions and mediating concepts of: - **First angle orthographic projection**: three-dimensional objects on flat paper. Explanation of instructions and mediating concepts of**:** - **Concept of drawing three different views**: front, top and side. Simple cubes. **Line types / conventions**: - dark, feint, dashed, wavy, chain. - Scale and dimensions **More complex 3D objects:** With instruments, drawn in orthographic projection.		Pictures / illustrations of **Design skills First angle orthographic projection, Concept of drawing three different views, Line types** (Practical demonstrations of video clips). Pictures / illustrations with explanation Pictures / illustrations/	

	Design brief: Specifying number of steps, height of stair risers, width and gradient of ramp, handrail, etc.	**Design problem**: Flight of stairs and wheelchair ramp **Design brief:** Specifying number of steps, height of stair risers, width and gradient of ramp, handrail, etc The teacher **introduces the PAT to the learners**	video clips   	
LEARNER	Learner activities: -First, understand what the theory implies and where you can apply it. -Do regularly exercises to become familiar to understand **Design skills, First Angle Orthographic Projection,** **Concept of drawing three different views – Front-, Side-, Top view** **Line types** Explain to someone at home what you understand regarding the theory and what it means. If there is a cell phone available, compile and make a 1-2-minute video where you explain your new knowledge. **Also refer to the video clips**.			
Informal / Formal Assessments	If the learner correctly explains the concept, then the learner has demonstrated that he / she has learnt.			
Values Taught	Does the design allow access to people of different age groups and with disabilities			

<table>
<tr><th>Content</th><th>Explanation</th></tr>
<tr><td>

Orthographic drawing



(Isometric view)

NB!
The front view will always be indicated.

</td><td>

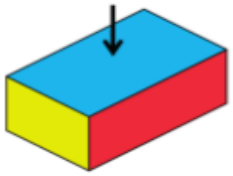
Activity 1

The word orthographic comes from two words. "Ortho" means looking straight at a flat face of an object. "Graphic" means a drawing.

You will now learn how to make **Orthographic** drawings. This means you will look at an object from different sides and make separate drawings of what you see of each surface separately.

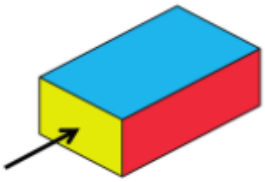
Look at this **isometric drawing** of a rectangular box. Three faces of the box are visible. Yellow surface, red surface and blue surface.

If you look straight down from **above** at the box, you will see the **blue** rectangle.



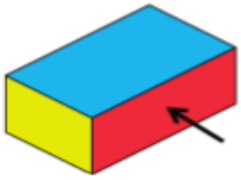
This is called the **top view.**

If you look at the box from the **left side**, you will see the **yellow** rectangle.



This is called a **side view.**

If you look at the box from the **front**, you will see the **red** rectangle.



This is called the **front view**.

</td></tr>
<tr><td>

First angle orthographic projections

</td><td>

First angle orthographic projections are normally drawn in blocks as shown here. The **front view is drawn first, in the upper left block**. **Construction lines** are then **drawn from the front view** to make it easier **to draw the top view and a side view**. A side view can also be called an end view.

Front view	Side view
Top view	

</td></tr>
</table>

Line Types

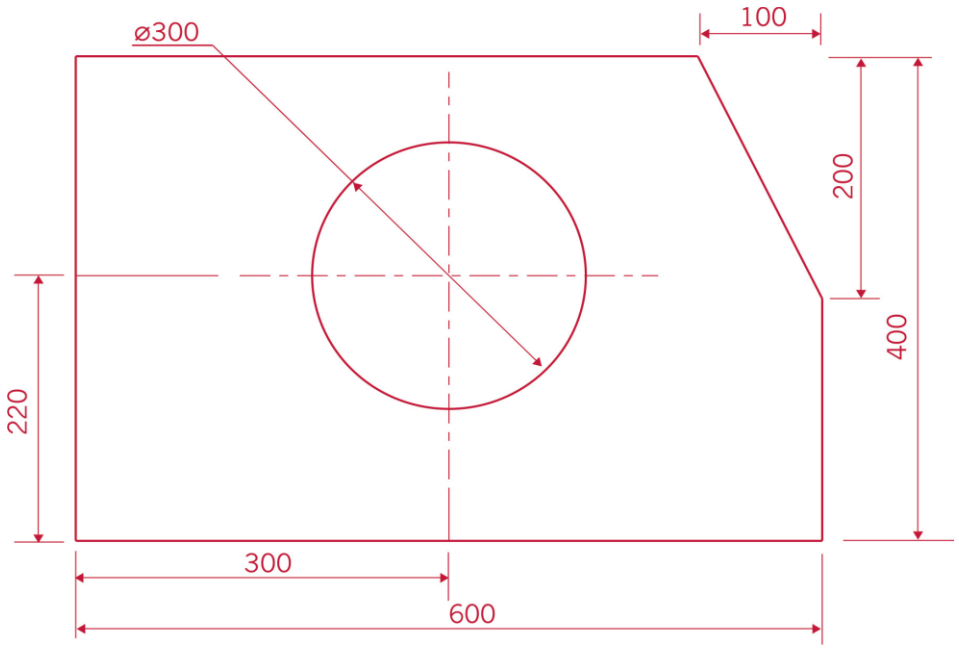
Grid papers provided to complete this activity 2.

Different type of lines, description and uses:

Line type	Line illustrated	Description and used for
Construction line	———————	Lines are **feint lines** that are used when planning out the drawing.
Visible line (Outlines)	———————	Lines are **heavier/darker** than the construction lines. They are the lines that are used to show visible edges.
Hidden line	- - - - - - - - - - - - - - -	Lines are **short dashes** of **equal length and spacing**. The lines are used to show something that is hidden for example like a hole or an edge- shows hidden detail.
Dimension line	100	Lines show the measurement between two points and are drawn finely. **Units are always in millimetres** (mm) so the unit is not normally indicated on the drawing. The measurement is **ALWAYS** on top of line and in the middle.
Centre line / Chain line	—— – —— - ——	Consists of a long line and a dash repeated; used to show the centre lines of a symmetrical object.

Dimensions

Illustration Dimensions can be horizontal, vertical, aligned or rotated



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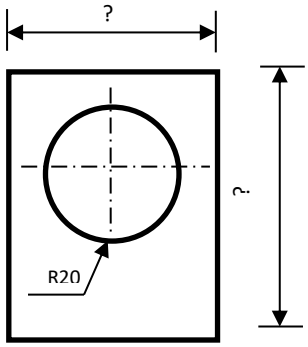
Activity 3:

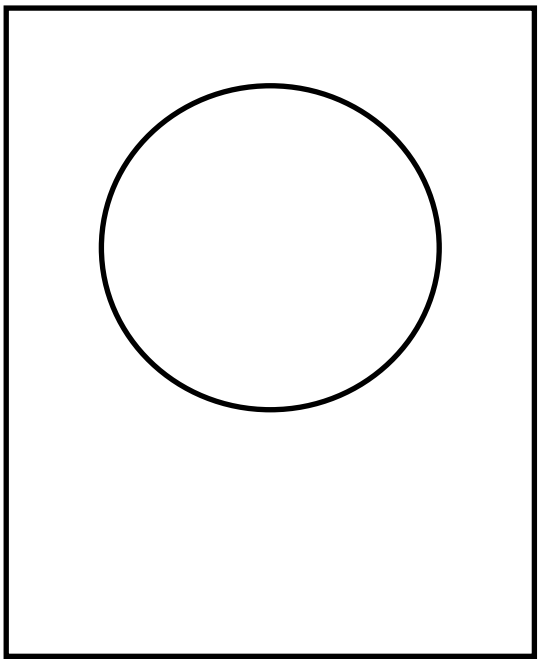
Practice dimension lines

Dimensioning is the process of adding measurement annotation to a drawing.

You can create dimensions for a variety of object types in many orientations.

- Study illustration 2 and then add the dimension lines to illustration 3.





Scale up or Down

Individually read the information below and study the examples provided.

You need to scale objects and products as in many cases they are far

Too big (or too small) to be able to draw their actual size on paper. It is

important to remember that if you are scaling down or up then all the measurements must be altered by the same factor.

A ratio is used in scale drawings of maps and buildings.

The scale of a drawing = **Drawing length : Actual length**

Ratios can be converted into fractions, as used in mathematics.

For example, if your drawing is to be a tenth of what it actually is then you need

to divide the **actual** dimensions by ten to get your **drawing** dimensions.

I.e. Ratio is 10:100 (all units in millimetres)

i. $\frac{\text{Drawing}}{\text{Actual}} = \frac{10}{100} = \frac{1}{10}$ answer 1:10 (scaling down)

If your drawing must be 10x bigger: then the ratio of 100:10 (all units in

millimetres)

ii. $\frac{\text{Drawing}}{\text{Actual}} = \frac{100}{10} = \frac{10}{1}$ answer 10:1 (scaling up)

Note: You will always indicate the actual dimension (true length) on the

scaled drawing.

Activity 4

- In pairs calculate the scale to the ratios and indicate if you are scaling up or down.

1. 100 : 25

_____

2. 20: 60

_____

3. 100: 20

_____

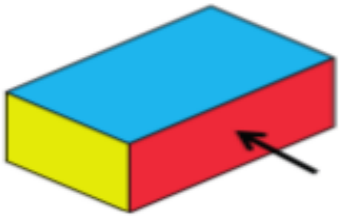
4. 50: 100

_____

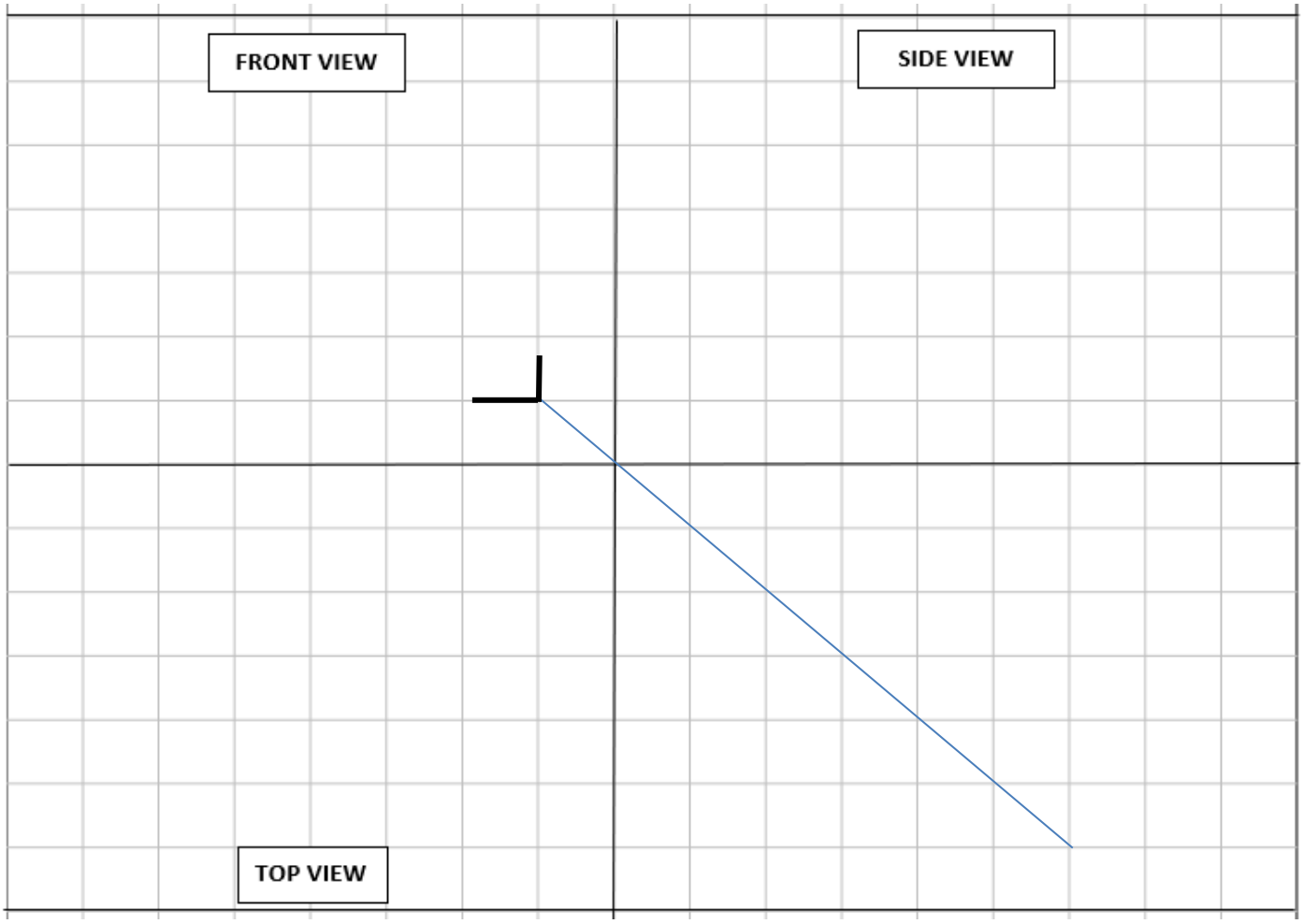
Content	Explanation
Task 1	By sketching a first angle Orthographic work drawing, it should include all details needed for making this product. These include instructions, dimensions, notes, etc. The formal layout of an Orthographic drawing with Front view, Side view and Top view need to be drawn on the given page with grid paper.
Links of videos to assist	https://www.youtube.com/watch?v=I-d9B9OWwhE https://www.youtube.com/watch?v=JJbI7W30mi4 https://www.youtube.com/watch?v=q6QQ2L69DAA https://www.youtube.com/watch?v=DCwo0W8aW9o https://www.youtube.com/watch?v=XzhKc6jD0ws https://www.youtube.com/watch?v=NgOX5kG8IwU https://www.youtube.com/watch?v=yBtD4KN83xY

My drawing: 1st angle orthographic projection

Activity 5: Answer Grid



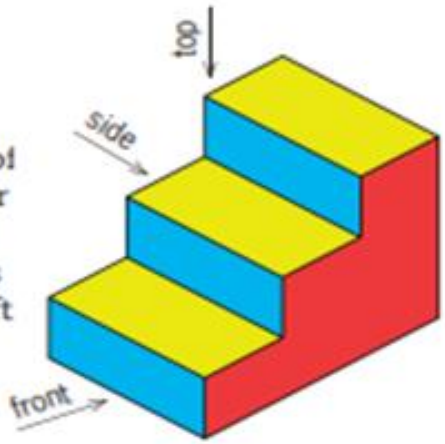
FRONT VIEW



Activity 6
Study an example of 1st angle orthographic projections, front view, side view and top view, provided to assist you... (You may use this example to practice, but not as your final orthographic working drawing)

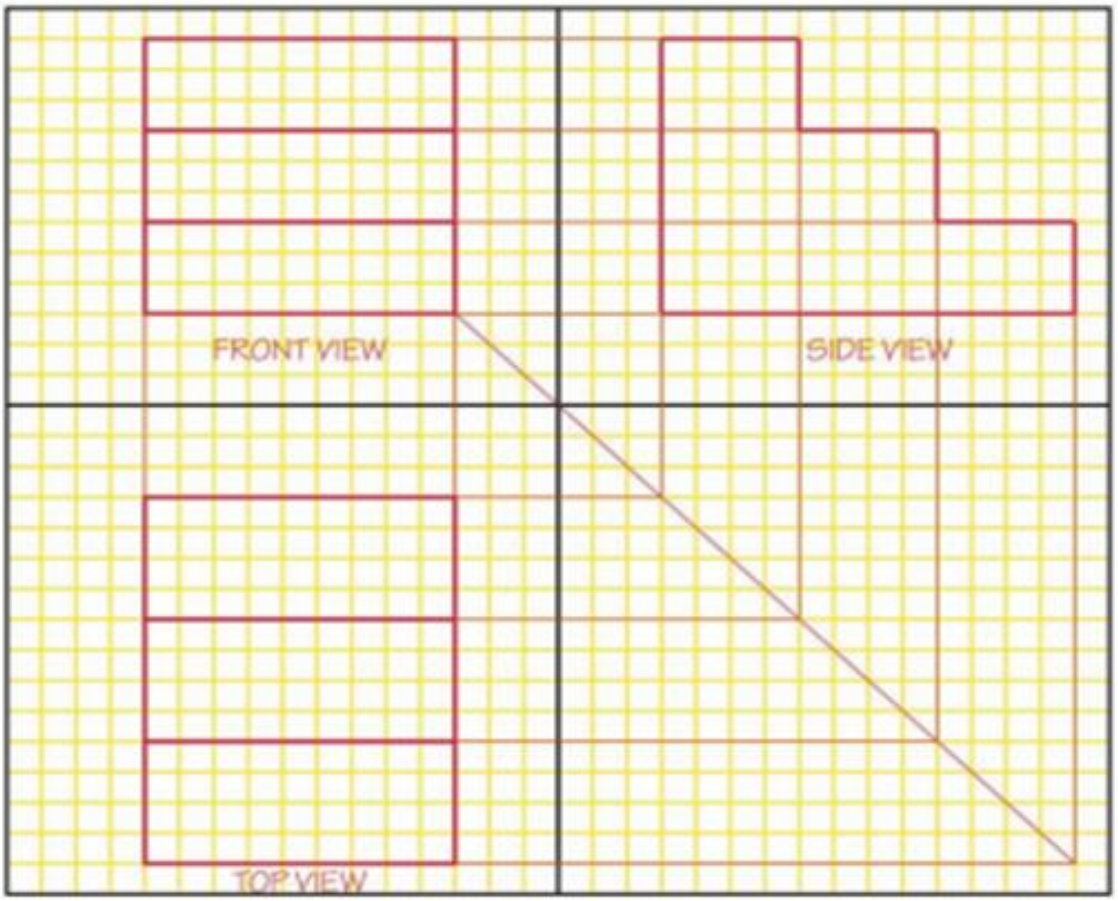
An orthographic drawing of a staircase

An isometric drawing of a mobile staircase is shown
The staircase is 900 mm wide.



1. Figure 16 in the Learner Book shows a front view of the staircase. Divide a sheet of grid paper into four blocks. Copy the front view onto the top left block of your sheet of paper. Now use construction lines to draw a top view and side view in the bottom left and top right blocks.

The completed drawing

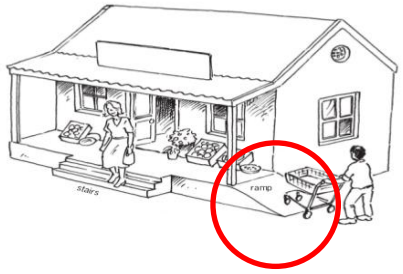


Answer Grid

Scenario: Provide for wheelchairs

Nelson Mandela High School in the Eastern Cape is brand new. It has a beautiful new community hall with a stage. Learners use the stage for dramas, fashion shows, music events and gospel choir performances. The architects designed great lighting and sound systems, but they forgot one very important thing: to provide access for wheelchairs so that disabled people can get onto the stage.

The principal asked the Grade 9 Technology students to design a mobile **staircase** and a **wheelchair ramp** that can be put in front of the stage.



Stairs and a ramp

Nelson Mandela High School has a new community hall. A staircase and wheelchair ramp is needed for the stage in the hall. The principal made a list of things that should be kept in mind when designing the staircase and wheelchair ramp. **They are called the specifications**

If you look at the picture on the page, you will see what a ramp is.

Activity 7
Analyze the scenario:
Step 1 - **Read** through the scenario.
Step 2 - **Highlight** or **underline words** that you do not understand. Refer to a **dictionary or the internet** to find the meaning of words.
Step 3 - **Circle** the **most important words** that will help Maria identify what **she must do**.
Step 4 - **Identify** and **write down** Maria's **design challenge**

Design Process
Engineers use the **Design Process** to **design and make** things that can **solve problems and challenges**. The design process has **five stages**: **Investigate, Design, Make, Evaluate and Communicate**.

Investigate	
Design Brief	1. **What** is it? (what is needed?); 2. **Who** it is for? 3. **What** is the **purpose** of it? 4. **Where** will it be used?
Design Specifications and **Constraints**	**Specifications** are **requirements** the **product must meet**. (Use the **key words** to identify **specifications** in a given scenario: **safety, size, material, function, human rights** and **environment**)
	Constraints are **limitations** in which the product or solution must be developed. (Use the **key words** to identify **constraints** in a given scenario: **time, material, cost, tools, human resources**)
	Use these **keywords** to guide you when **analyzing** the given scenario and to **identify** and list specifications and constraints.

Read through **sections** in the table.
Use the skills acquired in the table and answer the following questions:

Identify the problem in the scenario:

……

……

……

.

The specifications for the staircase and wheelchair ramp are:

- The stairs and ramp must be made in one unit so that it can be moved.
- The unit should fit in front of the stage so that people can walk onto the stage and wheelchairs can go up and down.
- The stage is 400 mm high.
- The stairs should be wide enough for two people, about 1200 mm.
- There should be three steps of the same size.
- The flat part of each step is 800 mm long.
- The ramp should be wide enough for one wheelchair 1000 mm.
- The slope of the ramp should be 2433 mm long.
- The ramp is at a 10° slope.
- The base of the ramp should be 2400 mm long.
- The ramp should have a handrail to prevent wheelchairs from falling off.

Write a design brief:

……

……

……

……

List the specifications

……

……

……

……

List the constraints

……

……

……

……

Guideline for setting the Practical Assessment Task **Total: 70 Marks**

This document is a guideline that educators can use to set their own assessment task for term 1.

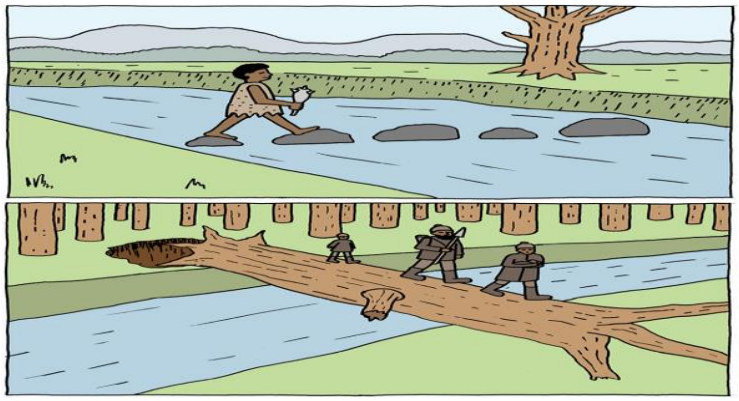
Educators can introduce the task at the start of the term. They can start the task after the first week. Each week learners can complete a part of the PAT, as the concepts or skills are covered in class.
In this way learners will have more time to complete the PAT.

Name		Possible mark	Learner's mark
Investigate (40 Marks)	Design brief, Specifications and constraints	20	
	Investigation	20	
Design (30 Marks)	Initial and final idea	30	
TOTAL		**70**	

Scenario

Pat 1: **A bridge to help the community**

Investigate granny Margaret Thabang's problem



Read through the following story:

Rivers provide much-needed water for communities, but sometimes they can also make life difficult for people. For example, during the rainy season, people from villages on one side of a river struggle to get to the other side of the river, if there is no bridge.
Many of the people in the KwaNogawu village next to the UThukela River in KwaZulu-Natal work on the other side of the river. The doctors, banks and shops that they need to visit are also on the other side.
School children cross this river to get to their schools, and the elderly have to walk through it once a month to collect their government grants from the offices on the other side.
Usually, the villagers cross the river on foot, because the nearest bridge is very far away. But during the rainy season, when the river is in flood, it becomes very dangerous. The water levels are so high that it is difficult to get through it safely, and the villagers have also seen crocodiles in the river. Everyone is scared of drowning or getting attacked by the crocodiles, but they don't have a choice and have to go through the river to get to the other side.

Write a few sentences to explain the problem the villagers have.

……
……
……
……

Can you suggest a few ways to help Granny Margaret Thabang cross the river?

……
……
……
……
……

Thukela Municipality

REQUEST FOR TENDER – Access Bridge for KwaNogawu Village

You are hereby invited to submit a tender for the requirements of the Thukela Municipality.

Tender Number: GH038

The successful tender must provide a safe, cost-effective solution for the villagers to cross the local river. The river is 100 meters wide at the crossing point. It rises during the winter rains and there are crocodiles in the river all year round.

Closing date:

Enquiries: Mrs Leslie Oats

A tender is a bid for work from a company. It gives details of how much the company would charge to complete a project.

The Thukela Municipality placed a tender request in the newspaper asking contractors to submit tenders for a structure to help people safely cross the river at KwaNogawu village.

Municipalities are not allowed to choose a contractor without giving as many contractors as possible a chance to apply. This is to stop anyone from being favoured over others, and to prevent corruption. Each contractor writes a tender document, which is a description of their plan for the project and shows how much they will charge to complete the work. The job is given to the contractor who presents the best plan at the lowest price.

You are going to build a structure to help the community. Read the story again and then investigate the different bridges below to decide which structure will be the best solution for the problem.

Design Brief, Specifications and Constraints **[20]**

1. Identify the design aspects: **(3)**
    a. What is it? (what is needed?)

        ……

    b. Who it is for? (Target)

        ……

    c. What it is for? (Function)

        ……

2. By making use of the above design aspects, complete the Design Brief. **(3)**

Design and make a ……..…… (What is needed) for a

……..…….. (Who is it for) that

…….…… (What is it for).

3. List Specifications. **(2x4=8)**

a. …

b. …

c. …

d. …

*An organized detailed description of the **requirements/criteria** that the solution or **product must meet**.*

*(E.g. **Safety, size, material, function, human rights, environment)***

4. List the constraints. **(2x3=6)**

a. …

b. …

c. …

*Aspects that **limit conditions** within which the **work or solution must be developed**.*

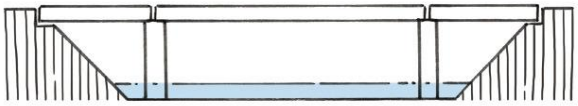
*(E.g. **Time, materials, tools, human resources, cost)***

Investigate

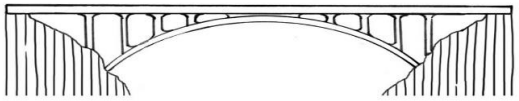
Analysis of existing products relevant to the identified problem in terms of fitness-for-purpose (including suitability of materials), safety for users, costs of materials and costs of construction. Realistic costs of real materials, labour, transport, etc.

Investigate structures to solve the problem

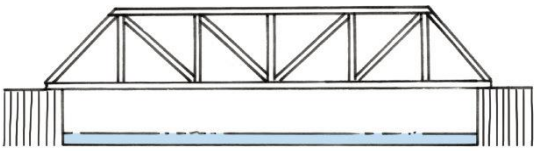
On this page and the next there are drawings of different types of bridges. You learnt about these bridges in Grade 8. Do you remember what the names mean? If you cannot remember, look at your Grade 8 book or ask your teacher to help you.



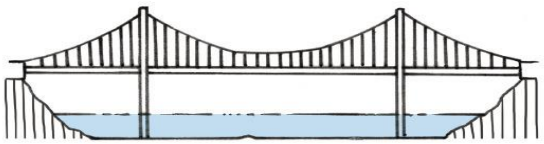
A beam and column bride



B: An arch bridge

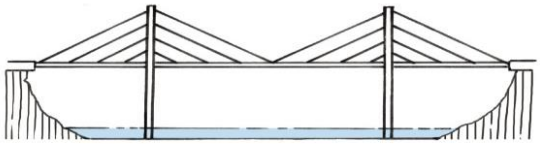


C: A truss bridge

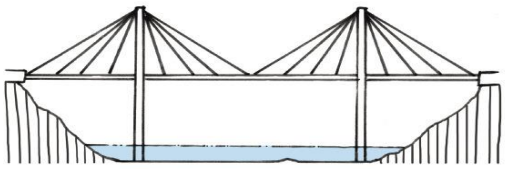


D: A suspension bridge

E: A cantilever bridge shape



F: A cable-stay bridge of the harp



G: A cable-stay bridge of the fan shape

H: H: A small suspension bridge

Different types of bridges use different materials and construction methods, but they all have a similar function.

In your group, discuss some of the advantages and disadvantages of each of the bridges for the community. Think about which parts will help the community, and which parts will not help.

If the bridge is meant to carry cars, it might be too expensive for your tender. Remember that the bridge has to solve the community's problem. In technology, we call this **fit-for-purpose**. In this case, it means that your bridge has to be strong and high enough to **carry people and not cars**. However, your bridge has to **be strong enough** to **withstand floods**, which are common in KwaZulu-Natal. Your bridge must also **be stable**, so that it **does not sway and cause old people and children to fall** when they walk across. It should have a **structure that can span a wide river**.

Use the following list to help you to investigate each of the bridges in Figure 5 on the previous page. Also bring pictures of bridges to school. You can find photographs of bridges in old newspapers and magazines.

Checklist for investigating bridges	**Yes**	**No**
Is the bridge for cars?		
Is the bridge for people?		
Is the bridge too expensive for the tender?		
Can the bridge be built strong and high enough so that it is not washed away by floods?		
Can the bridge be built so that it is stable and does not sway?		
Can the bridge be built long enough so that it can reach or span across the river?		
Is the bridge strong enough so that the villagers can walk safely across?		

[20]

Design **[30]**

Sketch initial ideas
Each learner generates two possible ideas. (Freehand sketches using Isometric/One Point Perspective or Two Point Perspective drawing skills

Idea 1 Develop rough sketches of ideas

Sketch your ideas here:

Idea 2

Evaluate and adapt your rough sketches

Your team will now prepare a tender. To start, choose the best design in your team. This means you need to choose one sketch from all the rough sketches. To help you choose, answer the following questions:

Questions	Yes	No
Does the structure allow people to move across the river safely?		
Does the structure protect people from crocodiles?		
Does the structure allow a group to cross safely?		
Will the structure be safe when the river floods?		
Is the structure durable, and will it last a long time without breaking?		
Is the structure made of the right materials? Remember that the bridge could be in constant contact with water and should not rust.		
Will the structure withstand both static and dynamic forces?		
Will the structure be very expensive to build? Remember that you are building it for people, not cars.		
Will the structure be expensive to maintain?		
Does the structure damage the environment?		

If the sketches do not meet these requirements, adapt them until they do.

Draw your adapted sketches in the space on the next page. This is your final solution and it will form the basis of your working drawing.

Make your sketches here:

Draw a flow chart

Do you remember what a flow chart is? A flow chart is a summary of all the steps you have to follow to plan or make something. It is a visual way to show the steps in a planning or making process.

"Visual" means something that you can see.

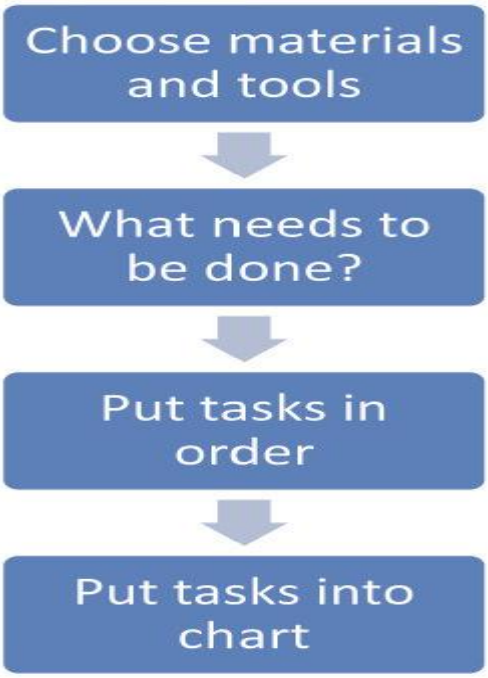
A flow chart is a summary, so use short sentences or just **keywords** to write down your steps. Then draw a box around each step and an arrow between the steps.

A **keyword** is a word that can replace a whole sentence. Example: for "Make a list of tasks', just write list'

Look at the example of a flow chart below. Now draw a flow chart of how you will build your bridge. Do this on the next page.

Think of the very first thing you will have to do, and start from there. For example: will you measure the river first; will you buy the materials first; will you train your staff first; or will you draw up your budget first?

You can change your flow chart later when you make the model of your bridge. Engineers and technologists often change their plans while they work on a project.



Draw your flow chart here:

Make working drawings

Working drawings are guides that show us how to build a specific structure. Make a working drawing of your bridge. It should be drawn to scale and show as much detail as possible.

Each member of your team should make their own first-angle orthographic projection of the bridge, showing the front view, top view and end view.

Each of your drawings should show the measurements of the structure and the scale you have chosen. Use correct line types.

You will need the following equipment:

- 30 °, 60 ° and 90 ° set square,
- a sharp pencil, and
- Masking tape to attach your drawing sheet to your drawing board.

My working drawing: 1st angle orthographic projection