basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

TECHNICAL MATHEMATICS

GUIDELINES FOR PRACTICAL ASSESSMENT TASKS

GRADE 12

2025

These guidelines consist of 25 pages.

TABLE OF CONTENTS

1. INTRODUCTION

The 18 Curriculum and Assessment Policy Statement subjects which contain a practical component all include a practical assessment task (PAT). These subjects are:

- AGRICULTURE: Agricultural Management Practices, Agricultural Technology
- ARTS: Dance Studies, Design, Dramatic Arts, Music, Visual Arts
- SCIENCES: Computer Applications Technology, Information Technology, Technical Sciences, Technical Mathematics
- SERVICES: Consumer Studies, Hospitality Studies, Tourism
- TECHNOLOGY: Civil Technology, Electrical Technology, Mechanical Technology, Engineering Graphics and Design

A practical assessment task (PAT) mark is a compulsory component of the final promotion mark for all candidates offering subjects that have a practical component and counts 25% (100 marks) of the examination mark at the end of the year. The practical assessment task for Technical Mathematics Grade 12 consists of three tasks (one task per term) which should be completed by end of Term 3. The tasks are COMPULSORY for ALL candidates offering **Technical Mathematics in Grade 12**.

The PAT is implemented during the first three terms of the school year. The PAT allows learners to be assessed regularly during the school year and it also allows for the assessment of skills acquired and it applies the science of Mathematics to the technical field where the emphasis is on application. It is therefore important that schools ensure that all learners complete the practical assessment tasks within the stipulated period to ensure that learners are promoted at the end of the school year. The planning and execution of the PAT differ from subject to subject.

The tasks should be administered under supervised conditions. Moderation may be done onsite, at the school.

2. TEACHER GUIDELINES

2.1 How to administer the PATs

- The following documents must be available for all formal tasks:
  - Task instructions explaining the procedures to be followed
  - The worksheets which include questions to be answered under examination conditions
  - The teacher guidelines with task instructions, worksheets and marking guidelines (The teacher guidelines MUST NOT be released to the learners.)
  - Teachers should compile marking guidelines (memoranda) for the real results of the task conducted (Teachers should do the tasks themselves FIRST.)
- The tasks must be done individually. Each learner must record his/her OWN INDIVIDUAL data and observations.
- Each learner must have his/her OWN worksheet and answer the questions INDIVIDUALLY under examination conditions.
- Only once all the learners are ready to do the task and they are seated, ready to answer the questions, may teachers hand out a worksheet to each learner. Examination conditions have to be applied.
- If it is not possible to do the task and complete the worksheet on the same day, the teacher must collect the learners' tasks. These tasks must be kept at the school.

2.2 Moderation of the PATs

For moderation, the following documents are required in the teacher's file:

- Index indicating all tasks with raw and weighted marks
- All task instructions
- Marking guidelines for all tasks, with ticks and totals
- Composite working mark sheet for all learners showing raw and weighted marks
- Evidence of internal moderation
- Evidence of administration of tasks, including registers

For moderation, the following documents are required in the learner's file:

- Index indicating all tasks with raw and weighted marks
- Answer sheets for all tasks

3. LEARNER GUIDELINES

3.1 The PAT for Grade 12 consists of THREE tasks.

3.2 The PAT contributes 25% towards your final promotion mark for Grade 12.

3.3 Group work is allowed as per the instructions. However, the work presented in the PAT must be your own.

3.4 Show ALL calculations clearly and include units. Round off answers to TWO decimal places. Use correct SI units where necessary.

4. EVIDENCE OF MODERATION

Learner's name:	
School:	

MARK ALLOCATION

TASK	MAX. MARK	WEIGHTING	LEARNER'S MARK (TEACHER)	MODERATED MARK (SCHOOL)	MODERATED MARK (DISTRICT)	MODERATED MARK (PROVINCE)
1	40	10				
2	30	7,5				
3	30	7,5				
TOTAL	100	25				
NAME						
SIGNATURES						
DATE						

DECLARATION OF AUTHENTICITY

I hereby declare that the project submitted for assessment is my own, original work and has not been submitted for moderation previously.

_____ _____
SIGNATURE OF LEARNER DATE

As far as I know, the above declaration by the learner is true and I accept that the work offered is his/her own.

_____ _____
SIGNATURE OF TEACHER DATE

SCHOOL STAMP

5. CONCLUSION

On completion of the practical assessment task, learners should be able to demonstrate their understanding of the subject, enhance their knowledge, skills, values and reasoning abilities as well as establish connections to life outside the classroom and address real-world challenges. The PAT furthermore develops learners' life skills and provides opportunities for learners to engage in their own learning.

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TECHNICAL MATHEMATICS

PRACTICAL ASSESSMENT TASK 1

GRADE 12

2025

MARKS: **40**

TIME: **8 hours**

SURNAME AND NAME	

SCHOOL	

This task consists of 7 pages (including the cover page).

TECHNICAL MATHEMATICS TASK 1

TOPIC: MENSURATION

AIM:

- **To use knowledge learnt in mensuration to construct a model of a water storage tank**
- **To determine the capacity and the volume of water in the water storage tank**

INTRODUCTION

Since 2015, South Africa has experienced water shortages. This is mainly because of climate change, which causes rainfall delays that eventually decrease dam levels, leading to droughts within the country.

The picture below shows water storage tanks.

The picture below shows a water storage tank with the following dimensions:

Diameter of the cylinder is 2,5 m
Height of the cylinder is 3 m
Height of the cone is 1,8 m

Resources:

1. Mathematical set
2. Material suitable for a model
3. Cutting object
4. Calculator
5. Binding material

Activities

1. Draw and label, in metres, the 3-D shapes that make up the water storage tank on the previous page.

	Solution	**Marks**
		(2)

2. Determine in metres, the magnitude of the slant height shown in the picture.

	Solution	**Marks**
		(2)

3. Convert the dimensions in the picture to centimetres. Use scale $1\text{ cm} : 0,25\text{m}$

	Solution			**Marks**
		Dimensions in metres	**Dimensions in cm**	
	Diameter of cylinder	2,5 m	…	
	Height of cylinder	3 m	…	
	Height of cone	1,8 m	…	
	Slant height	…	…	(4)

4. Draw and label, in centimetres, the dimensions of the nets of the 2D-shapes that make up a water storage tank. Hence, calculate the circumference and central angle, in degrees, where appropriate.

	Solution	**Marks**
		(7)

5. The activities below will be assessed using the rubric provided at the end of the task.

5.1 Make groups of at least four learners per group.

5.2 Choose the material suitable to make a model of a water storage tank.

5.3 Use the dimensions calculated in activities 3 and 4 to accurately draw the nets for the design of the water storage tank on the material chosen above.

5.4 Cut the nets accurately according to the drawn design of the storage tank.

5.5 Assemble the nets to form a water storage tank model.

RUBRIC FOR WATER STORAGE TANK MODEL
(This rubric will be used to assess instruction 5)

Criteria	3	2	1	Allocated marks
Attitudes and values	Very enthusiastic, no support needed to carry out instructions. The model was submitted on time.	Good motivation, no support needed to carry out instructions. The model was submitted on time.	Lack of motivation, needed support to carry out instructions. The model was not submitted on time.	
Team work	Strong ability to work collaboratively with team members, communicates, accepts responsibility and solves problems.	Ability to work collaboratively with team members, communicate, accepts responsibility and solves problems.	Inability to work collaboratively with team members, to communicate, accept responsibility and solve problems.	
Measurements	The dimensions of all three nets were accurately measured and could be used as a design for making the storage tank.	The dimensions of all three nets were moderately measured and could be used as a design for making the storage tank.	The dimensions of all three nets were poorly measured and could not be used as a design for making the storage tank.	
Cutting	The tool used to cut the nets was appropriate, correctly handled and the nets were accurately cut according to the design.	The tool used to cut the nets was appropriate, reasonably handled and the nets were moderately cut according to the design.	The tool used to cut the nets was inappropriate, incorrectly handled and the nets were not accurately cut according to the design.	
Model	The material chosen was flexible, and suitable to make and bind a model of a water storage tank.	The material used was partially suitable to make and bind a model of a water storage tank.	The material used was not suitable to make and bind a model of a water storage tank.	
				15

6. Determine, **in litres and showing ALL calculations,** the volume of water that has been used if the height level of water remaining in the tank is 1 metre. A diagram representing a storage water tank may be drawn to support the calculations.

	Solution	**Marks**
		(10)

TOTAL: 40

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TECHNICAL MATHEMATICS

PRACTICAL ASSESSMENT TASK 2

GRADE 12

2025

MARKS: **30**

TIME: **5 hours**

SURNAME AND NAME	

SCHOOL	

This task consists of 5 pages (including the cover page).

TECHNICAL MATHEMATICS TASK 2

TOPIC: Mensuration

AIMS:

- **To design and make a trundle wheel or click-wheel for measuring distances**
- **To use a trundle wheel to measure distance and apply mensuration knowledge to calculate area**

INTRODUCTION

A trundle wheel is a measuring device used to measure distances and is commonly used by surveyors, landscape designers, etc. The picture below shows an example of a trundle wheel.

Resources

1. Measuring tape
2. Suitable materials to make a wheel, handle, pointer and a clicker
3. Driller
4. Cutting material

Activities

1. Determine, in centimetres, the radius, if the circumference of the wheel of the trundle wheel is 1 metre.

	Solution	**Marks**
		(2)

2. The activities below will be assessed using the rubric provided at the end of the task. Learners are required to work in groups of at least four members.

   2.1 Draw the design of the wheel, with the radius calculated above on the material chosen.

   2.2 Cut the wheel accurately according to the design.

   2.3 Drill a hole at the centre of the wheel.

   2.4 Calibrate, in centimetres, the edge of the wheel using the measuring tape (see picture of trundle wheel).

   2.5 Make a trundle wheel by joining a wheel, handle, pointer and a clicker.

   2.6 Use a trundle wheel to measure the diameter of a circular emergency assembly area. See the picture of a circular assembly area in activity 3.

   NOTE: The school that does not have a circular assembly area should construct one.

3. The Grade 12 Technical Mathematics Class is asked to do a quotation for paving a circular emergency assembly area for the school. Regular hexagonal slabs, with each side equal to 10 cm, are to be used for the paving and each slab costs R4,50. The pictures below show the circular emergency assembly area and hexagonal slabs respectively.

Circular assembly area

Hexagonal slab

Determine how much it will cost to pave the emergency assembly area.
NOTE: Area of the hexagonal slab must not be rounded off

	Solution	**Marks**
		(10)

Criteria	3	2	1	Allocated marks
Attitudes and values	Very enthusiastic, no support needed to carry out instructions. The model of a trundle wheel was submitted on time.	Good motivation, no support needed to carry out instructions The model of a trundle wheel was submitted on time.	Lack of motivation, needed support to carry out instructions. The model of a trundle wheel was not submitted on time.	
Team work	Strong ability to work collaboratively with team members, communicate and accept responsibility.	Ability to work collaboratively with team members, communicate and accept responsibility.	Inability to work collaboratively with team members, communicating and accepting responsibility at low level.	
Measurements	The trundle wheel has been constructed and calibrated accurately; the radius is precise and the circumference is exactly 100 cm.	The trundle wheel is moderately constructed and fairly calibrated, the radius is correct and the circumference is almost 100 cm.	The trundle wheel is not accurately constructed, the radius is imprecise and the circumference is not exactly 100 cm.	
Use of tools	Tools were appropriately handled, and safety measures were observed when cutting the wheel and drilling the hole.	Tools were appropriately handled, and safety measures were partially observed when cutting the wheel and drilling the hole.	Tools were not appropriately handled, and safety measures were observed when cutting the wheel and drilling the hole.	
Model	The material used was suitable to make a stable and functional trundle wheel.	The material used was partially suitable to make a stable and functional trundle wheel.	The material used was not suitable to make a stable and functional trundle wheel.	
Functionality of the trundle wheel	Trundle wheel is functional and appropriately used to accurately measure the distance of the diameter of the assembly area.	Trundle wheel is functional and appropriately handled and could measure the diameter of the assembly area.	Trundle wheel is not functional, inappropriately used and could not be used to measure the diameter of the assembly area.	
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TOTAL: 40

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TECHNICAL MATHEMATICS

PRACTICAL ASSESSMENT TASK 3

GRADE 12

2025

MARKS: **30**

TIME: **2 hours**

SURNAME AND NAME	

SCHOOL	

This task consists of 7 pages (including the cover page).

TECHNICAL MATHEMATICS TASK 3

TOPIC: TRIGONOMETRY AND ANGULAR MOVEMENT

AIMS:

- **To explore the change in vertical displacement (height) of an object undergoing angular movement with its angle of rotation**
- **To generate a trigonometric graph describing the motion of an object undergoing rotational motion**
- **To apply angular movement in real life context**

INTRODUCTION

A **Ferris wheel** (also called an **observation wheel**) is an amusement ride consisting of a rotating upright wheel with multiple passenger-carrying components (commonly referred to as passenger cars, pods or cabins) attached to the rim in such a way that as the wheel turns, they are kept upright, usually by gravity. As a Ferris wheel rotates, each passenger cabin undergoes a rotational motion.

Materials needed

1. Protractor
2. Ruler
3. Calculator
4. Graph paper

Activities

1. Draw a circle with a radius of 5 cm on graph paper. Indicate point A on the circle along the positive horizontal axis. The horizontal axis represents the angular displacement (theta), in degrees, and the vertical axis the height reached by point A, in centimetres. Mark equal angles of 30° around the centre of the circle.

   NOTE: Graph paper must be handed in with PAT Task 3. (3)

2. Rotate point A about each angle shown in the table below and measure, in centimetres, the height reached by point A.

   Hence, complete the table below.

   Solution

Angles (degrees)	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
Angular displacement (rad)													
Height (cm)													

(3)

3. Draw, on graph paper, the graph representing the motion of a rotating point A (height vs angular displacement) if the Ferris wheel rotates anticlockwise. Scale the horizontal axis, angular displacement (theta) in radians and the vertical axis, the height reached by point A, in centimetres.

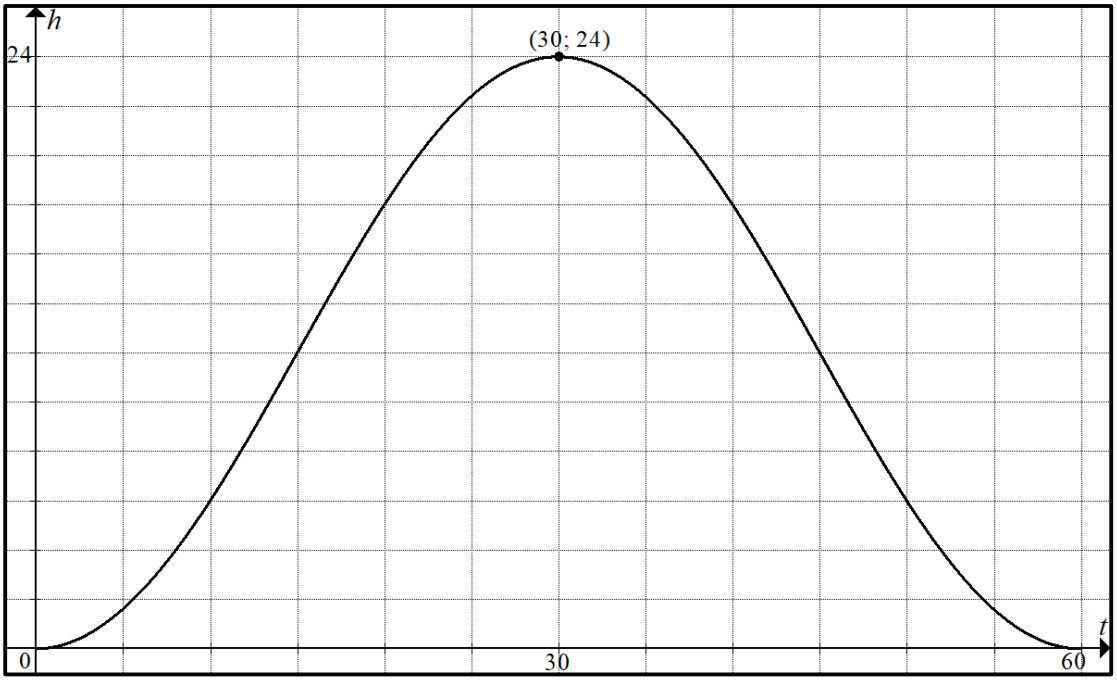
   NOTE: Graph paper must be handed in with PAT Task 3. (3)

4. Write down the equation of the trigonometric function generated by this motion:
   $h(\theta) = a\sin\theta$

	Solution	**Marks**
		(1)

5. In the picture below, the Ferris wheel, with radius 12 metres, rotates anticlockwise and completes one revolution every one minute. At the lowest point, each passenger cabin is on the ground level.

As each passenger cabin rotates, it creates the sinusoidal (sine or cosine graph) motion represented by the height (in metres) vs time (in seconds) graph below:



The graph above could be represented by a sine or cosine function of the format:

$y = a\sin\ \omega t + q$ OR $y = a\cos\ \omega t + q$ where

- a *is* the amplitude (half the difference between the highest and lowest point)
- ω is the angular velocity; $\omega = \frac{\theta}{t}$, then $\theta = \omega t$
- q is the vertical shift

5.1 Which ONE of the two functions best represents the graph above?

	Solution	**Marks**
		(1)

5.2 Determine the angular velocity of the wheel, in radians per second.

	Solution	**Marks**
		(3)

5.3 Determine the equation of the trigonometric function representing the motion of a Ferris wheel.

	Solution	**Marks**
		(3)

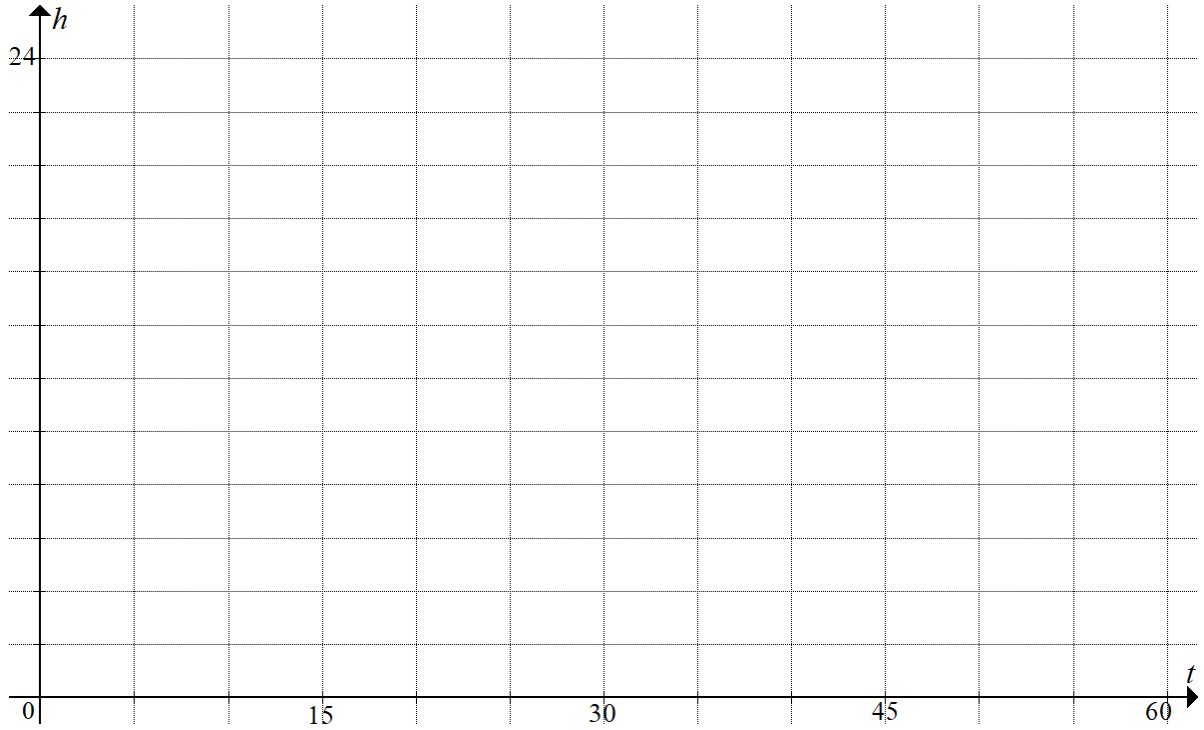
5.4 Determine the circumferential velocity (υ) of a passenger sitting in a cabin.

	Solution	**Marks**
		(3)

5.5 If the rotational frequency is doubled, determine the new angular velocity.

	Solution	**Marks**
		(1)

5.6 Draw the graph to show the effect of doubling the rotational frequency.

	Solution	Marks
		(3)

5.7 Describe the effect that doubling the rotational frequency has on the graph.

	Solution	Marks
		(2)

5.8 If the Ferris wheel completes three rotations in 90 seconds, what is the circumferential velocity of a passenger sitting in a cabin, in km/h?

	Solution	**Marks**
		(4)

TOTAL: 30