basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

TECHNICAL MATHEMATICS

GUIDELINES FOR PRACTICAL ASSESSMENT TASKS

GRADE 12

2026

These guidelines consist of 38 pages.

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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
- SERVICES: Consumer Studies, Hospitality Studies, Tourism
- TECHNOLOGY: Civil Technology, Electrical Technology, Mechanical Technology, Engineering Graphics and Design
- TECHNICAL: Technical Mathematics, Technical Sciences

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.

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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.

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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

2026

MARKS: **40**

TIME: **4 hours**

SURNAME AND NAME	

SCHOOL	

This task consists of 8 pages (including the cover page)
and a 2-page information sheet.

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PRACTICAL ASSESSMENT TASK 1 (INDIVIDUAL TASK)

TOPIC: CIRCLES, ANGLES AND ANGULAR MOVEMENT

AIM:

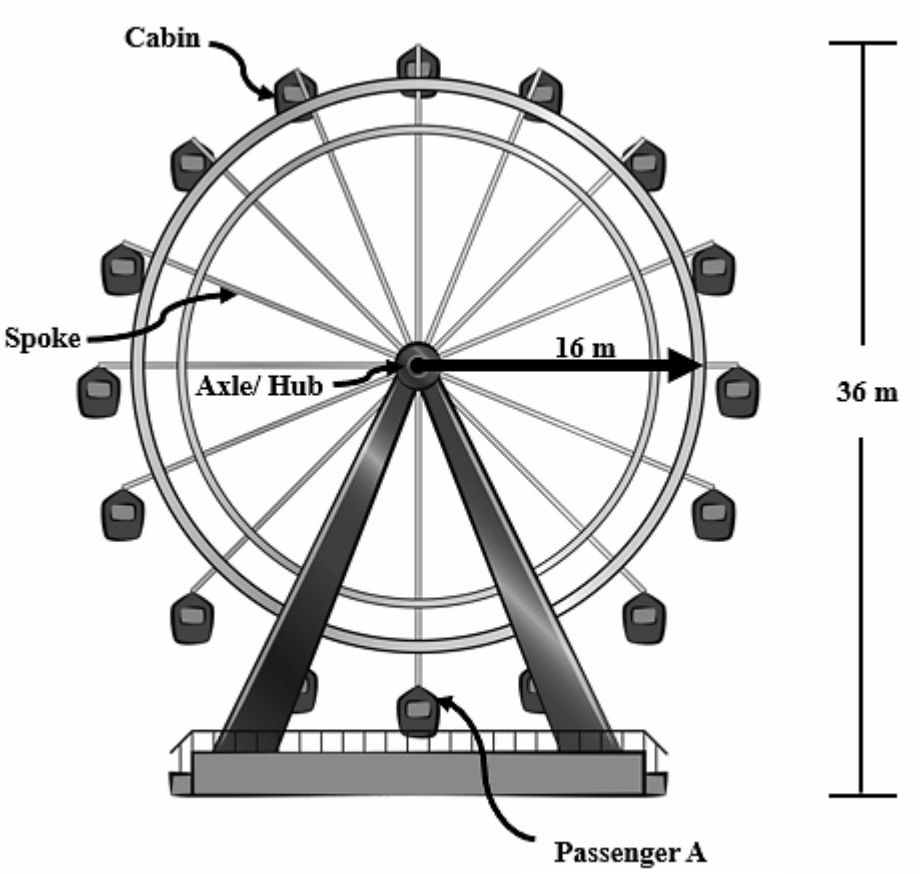
- **To use knowledge learnt about circles, angles and angular movement to make a poster of a Ferris wheel**
- **To apply knowledge of circles, angles and angular movement in real life context**

INTRODUCTION

A Ferris wheel (also called a big wheel, giant wheel or an observation wheel) is an amusement ride, consisting of a rotating upright wheel with multiple passenger-carrying components (commonly referred to as passenger cars, cabins, tubes, gondolas, capsules or pods) attached to the rim in such a way that as the wheel turns, these components are kept upright, usually by gravity.

The picture below shows a Ferris wheel with a height of 36 m and a radius (hub or axle radius plus length of spoke) of 16 m. The Ferris wheel consists of 16 spokes which divide the wheel into 16 equal sectors. Each cabin is positioned at the end of the spoke on the edge of a wheel.

NOTE: The material used to attach the cabins is not part of the radii of the Ferris wheel.



Resources required to make a poster of a Ferris wheel:

- Cardboard or Paper (A2 or A3 size)
- Geometry set
- Pencil
- Ruler or measuring tape

Instructions:

1.	Convert the radius of the Ferris wheel to centimetres using the scale *1 m : 1 cm.*	(1)

2.	Calculate, in degrees, the size of the angle (angular displacement) between any two consecutive radii (spokes).	(2)

3.	Calculate, in centimetres, the arc length between any two consecutive cabins.	(3)

4.	• Draw a circle, representing the Ferris wheel, on an A2 or A3 chart with the radius calculated above. • Divide the circle into 16 equal sectors ensuring that the radii (spokes) are equally spaced. • Indicate, on the circle, the position of each cabin by marking a dot at the end of each spoke. • Label the measurements calculated in Step 1 to Step 3 on the poster. Radius and arc length must be labelled in metres. • Give a suitable heading for the poster.	

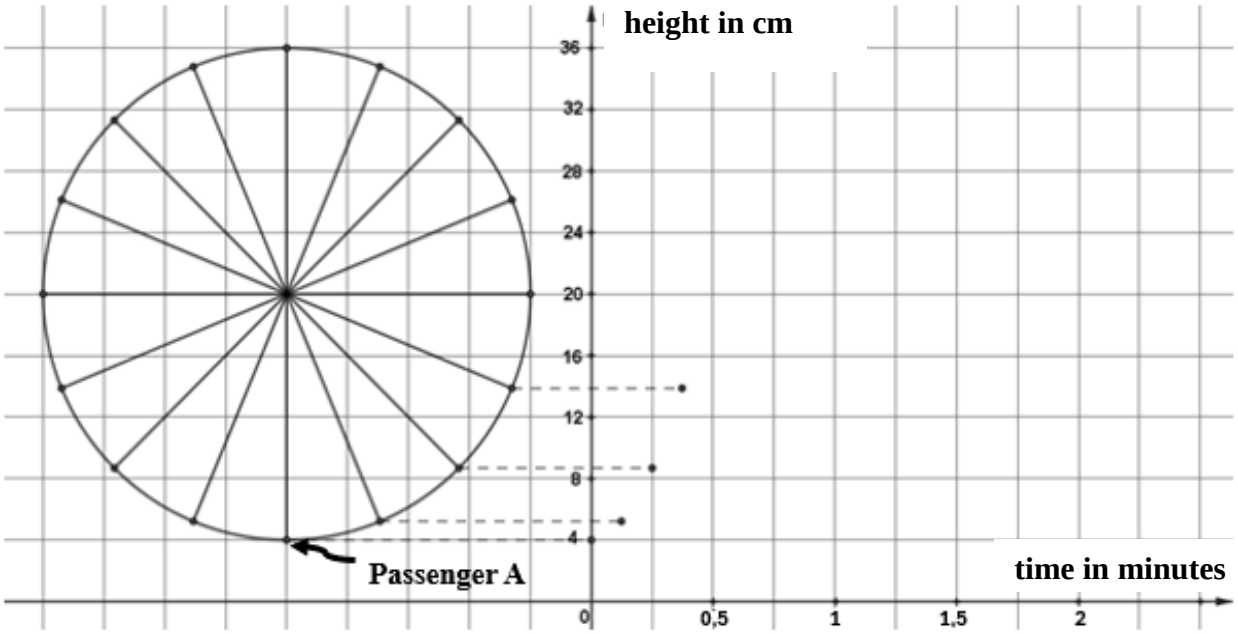
5.	Verify your answer calculated in Step 2 by measuring the angle, in degrees, using a protractor.	(1)

6.	Verify your answer calculated in Step 3 by measuring, in centimetres, the arc length using a ruler and/or flexible measuring tools.	(1)

RUBRIC FOR THE FERRIS WHEEL POSTER (STEP 4)

CRITERIA	0	1	2	3	Marks allocated
Attitude	Not motivated, cannot carry out instructions.	Shows limited motivation; needs frequent guidance.	Highly motivated and enthusiastic; completes task diligently and independently.		
Values	The poster was not submitted.	The poster was submitted late.	The poster was submitted on time.		
Measuring skills	The poster is not a representation of the Ferris wheel and all dimensions are inaccurate.	The poster is a representation of the Ferris wheel with a limited degree of accuracy.	The poster is a good representation of the Ferris wheel with most dimensions accurately measured.	The poster is an excellent representation of the Ferris wheel with all dimensions accurately measured.	
Labelling	No measurements on the poster are correctly labelled.	Limited number of measurements are labelled on the poster.	Most measurements are correctly labelled in precise units on the poster.	The poster is perfectly labelled in precise units, showing the radius, arc length and cabins.	
Heading and Presentation	No heading or inappropriate title, poor presentation.	Heading present but not suitable, limited effort in the design.	Suitable heading provided, poster is generally neat.	Clear, relevant heading, poster is well-organised, visually appealing, and easy to interpret.	
				SUBTOTAL:	**13**

7. The rotational motion of the Ferris wheel can be represented as a sinusoidal (trigonometric) function.



	Given that one revolution of the Ferris wheel takes 2 minutes, draw on the grid provided above the graph representing the motion of passenger A during one complete revolution. The first four points are plotted for you.	(3)

8.	Determine, in revolutions per second, the rotational frequency of the Ferris wheel.	(2)

9.	Determine, in radians per second, the angular velocity of the Ferris wheel.	(3)

10.	The equation of the trigonometric graph sketched in QUESTION 7 could be represented by a cosine function of the format: $f(t) = -a\cos(\omega t) + q$ where: • a is the amplitude (half the difference between highest and lowest points) • ω is the angular velocity; $\omega = \frac{\theta}{t}$, then $\theta = \omega t$ • q is the vertical shift Determine the values of a, ω and q.	(3)

11.	Calculate (in metres) the height of PASSENGER A above ground level at 1 minute.	(2)

12.	Calculate, in minutes, the time interval during which PASSENGER A reaches a height greater than 28 m above ground level.	(6)

TOTAL: 40

INFORMATION SHEET: TECHNICAL MATHEMATICS

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad x = -\frac{b}{2a} \qquad y = \frac{4ac - b^2}{4a}$$

$$a^x = b \Leftrightarrow x = \log_a b, \quad a > 0, a \neq 1 \text{ and } b > 0$$

$$A = P(1 + ni) \qquad A = P(1 - ni) \qquad A = P(1 + i)^n \qquad A = P(1 - i)^n$$

$$i_{eff} = \left(1 + \frac{i}{m}\right)^m - 1$$

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$$\int k x^n \, dx = k \cdot \frac{x^{n+1}}{n+1} + C \quad , n \neq -1$$

$$\int \frac{k}{x} dx = k \cdot \ln x + C, \quad x > 0$$

$$\int k a^{nx} \, dx = k \cdot \frac{a^{nx}}{n \ln a} + C \quad , a > 0$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \qquad M\left(\frac{x_2 + x_1}{2}; \frac{y_2 + y_1}{2}\right)$$

$$y = mx + c \qquad y - y_1 = m(x - x_1) \qquad m = \frac{y_2 - y_1}{x_2 - x_1} \qquad \tan\theta = m$$

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

In ΔABC: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $\qquad a^2 = b^2 + c^2 - 2bc \cdot \cos A$

$$\text{Area of } \Delta ABC = \frac{1}{2} ab. \sin C$$

$$\sin^2\theta + \cos^2\theta = 1 \qquad 1 + \tan^2\theta = \sec^2\theta \qquad 1 + \cot^2\theta = \text{cosec}^2\theta$$

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π rad $= 180°$

Angular velocity $= \omega = 2\ \pi\ n$ where n = rotation frequency

Angular velocity $= \omega = 360°\ n$ where n = rotation frequency

Circumferential velocity $= v = \pi D n$ where D = diameter and n = rotation frequency

Circumferential velocity $= v = \omega\ r$ where ω = angular velocity and r = radius

Arc length $= s = r\theta$ where r = radius and θ = central angle in radians

Area of a sector $= \frac{r\,s}{2}$ where r = radius, s = arc length

Area of a sector $= \frac{r^2\,\theta}{2}$ where r = radius and θ = central angle in radians

$4h^2 - 4d\,h + x^2 = 0$ where h = height of segment, d = diameter of circle and x = length of chord

$A_T = a\left(m_1 + m_2 + m_3 + ... + m_n\right)$ where $a =$ width of equal parts, $m_1 = \frac{o_1 + o_2}{2}$ $o_n = n^{th}$ ordinate and n = number of ordinates

OR

$A_T = a\left(\frac{o_1 + o_n}{2} + o_2 + o_3 + ... + o_{n-1}\right)$ where $a =$ width of equal parts, $o_n = n^{th}$ ordinate and n = number of ordinates

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TECHNICAL MATHEMATICS

PRACTICAL ASSESSMENT TASK 2

GRADE 12

2026

MARKS: **30**

TIME: **5 hours**

SURNAME AND NAME	

SCHOOL	

This task consists of 9 pages (including the cover page)
and a 2-page information sheet.

PRACTICAL ASSESSMENT TASK 2 (Group activity, 3 to 5 members)

TOPIC: Angular Movement

AIM:

- **To investigate the relationship between angular velocity and circumferential velocity when the radius of a wheel is kept constant**
- **To investigate the relationship between the radius and circumferential velocity of points located at different distances from the centre of a wheel when the angular velocity is kept constant**

Equipment needed:

1. Bicycle wheel
2. Stopwatch
3. Measuring tape
4. Colour tape or marker
5. Clicker (e.g. thin plastic strip)
6. Calculator

THE WHEEL OF A BICYCLE WITH CENTER A AND A FOCAL POINT E

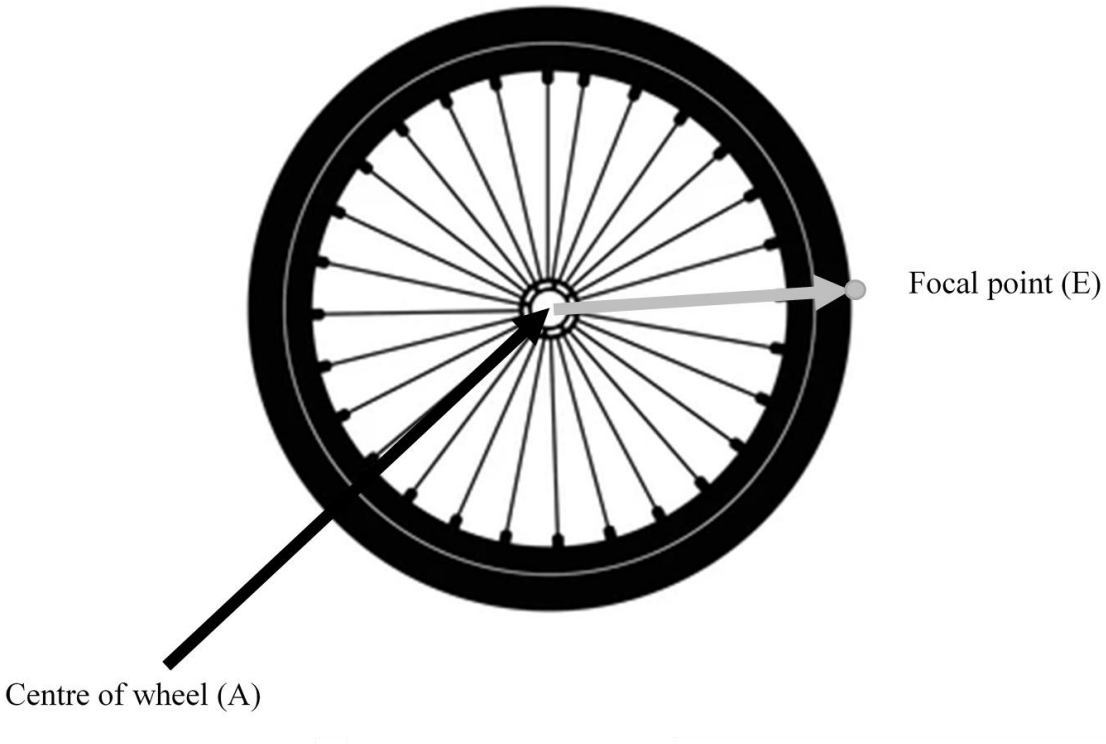
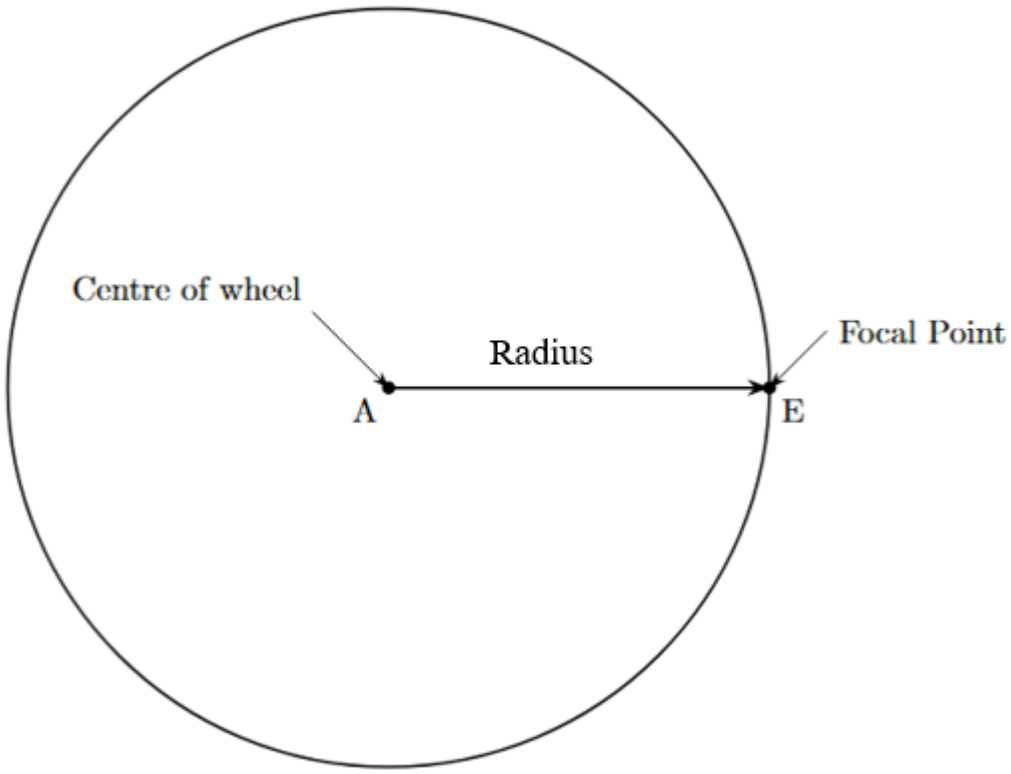


DIAGRAM REPRESENTING THE WHEEL OF A BICYCLE



ACTIVITY 1: INVESTIGATING THE RELATIONSHIP BETWEEN ANGULAR VELOCITY AND CIRCUMFERENTIAL VELOCITY

Instructions:

1.1	Secure or mount the wheel such that its axis of rotation remains fixed.
1.2	Measure the circumference of the wheel and record its radius (m) in the table provided in Step 1.8 on the next page.
1.3	Use chalk or tape to clearly mark a focal point on the outer edge of the wheel. This mark will serve as a visual indicator to track each complete revolution of the wheel.
1.4	Place a clicker at the focal point so that it produces a click each time the focal point passes the identified reference point.
1.5	Spin or rotate the wheel by hand. For each spin, apply a different force so that the rotational frequency changes every time.
1.6	Count the number of full revolutions each time the focal point passes the reference point.
1.7	Record the time(s) taken for the reference point to complete five revolutions, in the table provided in Step 1.8 on the next page.

1.8	Repeat Steps 1.5 to 1.7 five times and record your findings in the table below.

TABLE 1

Trial	No of rotations	Radius of the wheel (m)	Time (s)	Angular velocity (rad/s)	Circumferential velocity (m/s)
1	5				
2	5				
3	5				
4	5				
5	5				

1.9	Complete the table above by calculating the following: • The **angular velocity (ω)** of the wheel • The **circumferential velocity (v)** of the point on the edge of the wheel The table below may also be used to record the angular velocity (in ascending order) and the corresponding circumferential velocity calculated above.

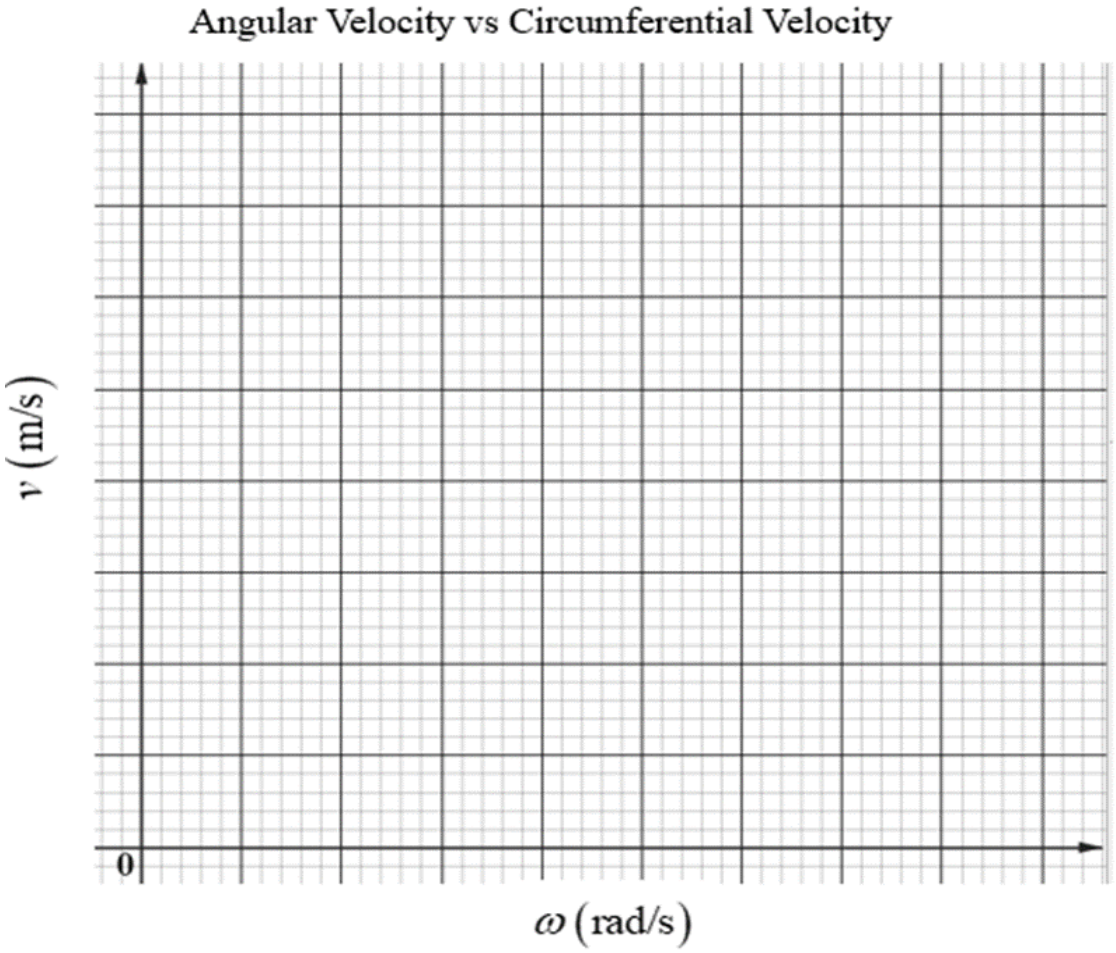
TABLE 2

Angular velocity (rad/s)	0					
Corresponding circumferential velocity (m/s)	0					

Calculations:

Calculations (cont.):	(5)

1.10	Use the grid below to draw a clear graph that represents the relationship between the angular velocity of the wheel and the circumferential velocity of the point on the edge of the wheel.

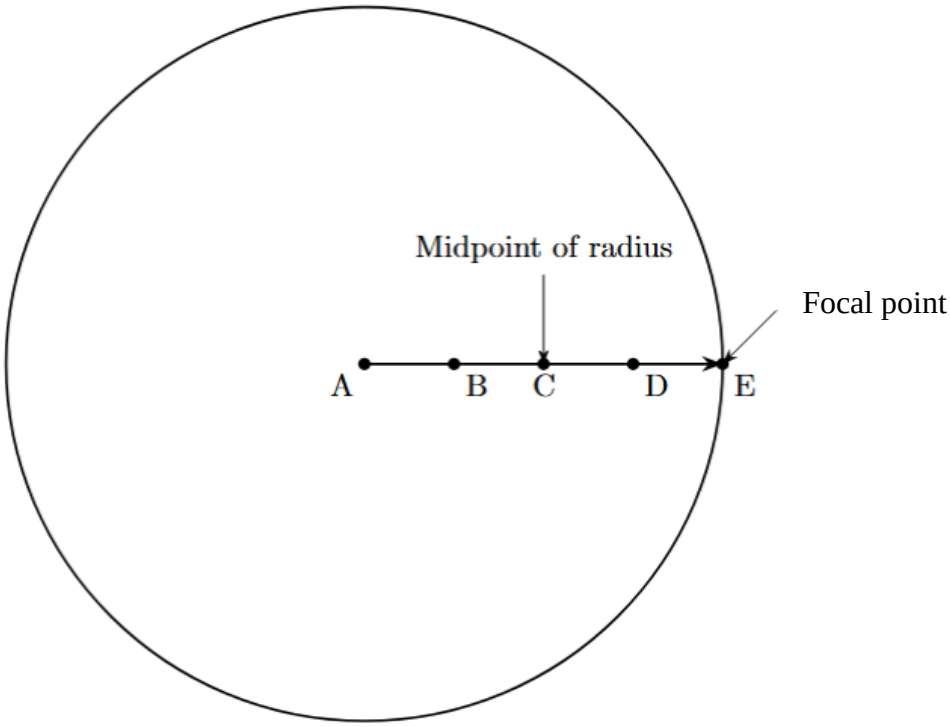


(4)

1.11	Based on the table and the graph drawn in Step 1.10, briefly explain the relationship between angular velocity and circumferential velocity of a point on the edge of a wheel.	(2)

ACTIVITY 2: INVESTIGATING THE RELATIONSHIP BETWEEN RADIUS AND CIRCUMFERENTIAL VELOCITY

DIAGRAM REPRESENTING THE WHEEL WITH POINTS A TO E ALONG THE RADIUS



Instructions:

2.1	Measure the length from the centre of the wheel to each of the identified points B to E and record your findings in the table on the next page.

2.2	Record, in the table below, the angular velocity of the wheel chosen from ONE of the trials in activity 1 for all the points A to E.

TABLE 3

Position	**Radius (m)**	**Angular velocity (rad/s)**	**Circumferential Velocity (m/s)**
A (centre)	0		
B			
C			
D			
E			

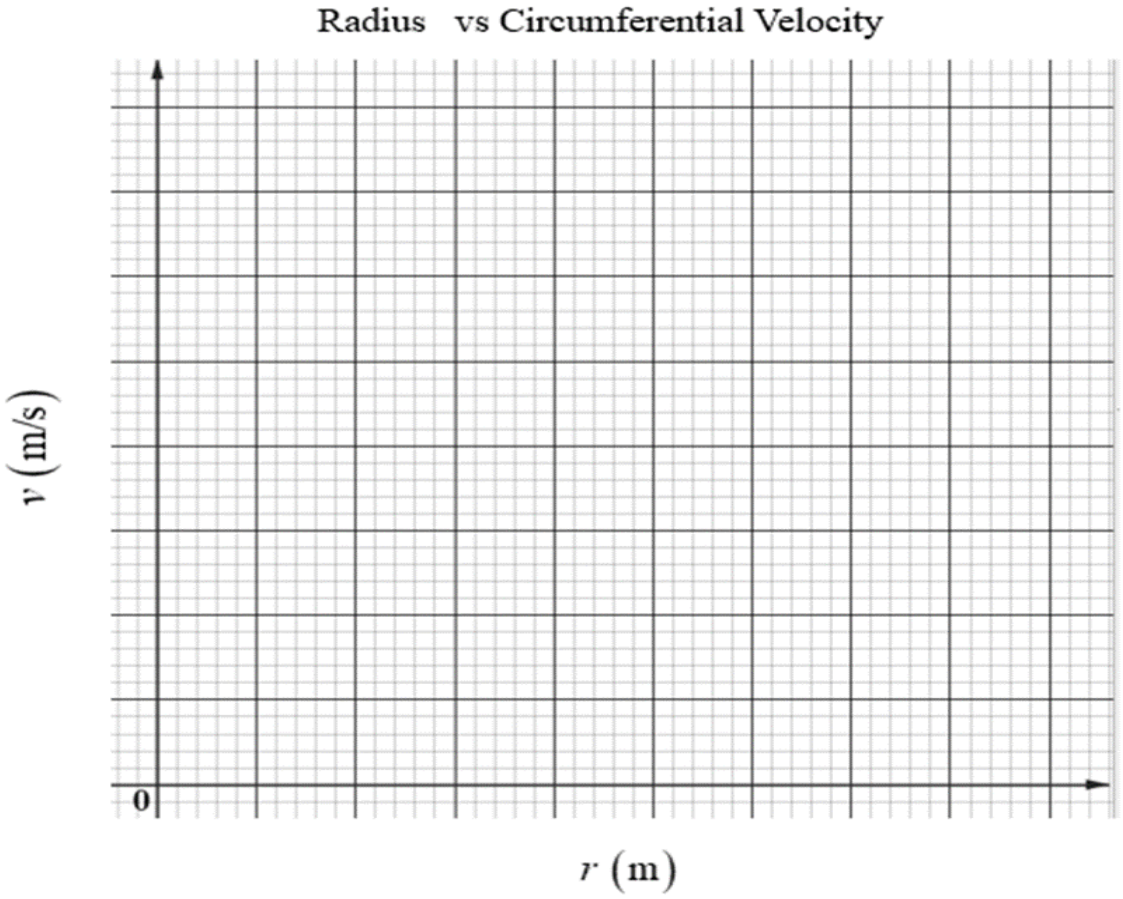
2.3	Complete the table above by calculating, in m/s, the circumferential velocity for each point A to E marked along the radius of the wheel.

Calculations:

Calculations (cont.):

(4)

2.4	Use the grid below to draw a graph that represents the relationship between the radius of the wheel and the circumferential velocity of the points located at different distances from the centre of the wheel.



(4)

2.5	Based on the table and the graph drawn in Step 2.4, describe the relationship between the radius and the circumferential velocity of points located at different distances from the centre of the wheel.	(2)

RUBRIC FOR STEPS 1.1 TO 1.8 AND STEPS 2.1 TO 2.2

CRITERIA	0	1	2	3	Marks allocated
Attitudes and values	Not motivated and cannot follow instructions. No respect for peers and teamwork.	Shows limited motivation. Follows instructions poorly and limited respect for peers and teamwork.	Motivated. Mostly follows instructions and mostly shows respect for peers and teamwork.	Highly motivated. Follows instructions and shows respect for peers and teamwork.	
Experimental skills	The wheel is not secured, no accurate marking, clicker incorrectly placed.	The wheel is unstable, markings unclear, clicker inconsistently positioned	The wheel is fairly stable, markings and clicker functional.	The wheel is securely fixed, markings and clicker are well positioned.	
Measuring skills	Measurements of time and radii are incorrectly recorded.	Some measurements of time and radii are recorded, but with limited accuracy and consistency.	Measurements of time and radii are mostly accurate. There are minor errors in recordings.	All measurements of time and radii are accurate and clearly recorded in correct units.	
	SUBTOTAL:				**9**

TOTAL: 30

INFORMATION SHEET: TECHNICAL MATHEMATICS

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad x = -\frac{b}{2a} \qquad y = \frac{4ac - b^2}{4a}$$

$$a^x = b \Leftrightarrow x = \log_a b, \quad a > 0, a \neq 1 \text{ and } b > 0$$

$$A = P(1 + ni) \qquad A = P(1 - ni) \qquad A = P(1+i)^n \qquad A = P(1-i)^n$$

$$i_{eff} = \left(1 + \frac{i}{m}\right)^m - 1$$

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$$\int k x^n \, dx = k \cdot \frac{x^{n+1}}{n+1} + C \quad , n \neq -1$$

$$\int \frac{k}{x} dx = k \cdot \ln x + C, \quad x > 0$$

$$\int k a^{nx} \, dx = k \cdot \frac{a^{nx}}{n \ln a} + C \quad , a > 0$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \qquad M\left(\frac{x_2 + x_1}{2}; \frac{y_2 + y_1}{2}\right)$$

$$y = mx + c \qquad y - y_1 = m(x - x_1) \qquad m = \frac{y_2 - y_1}{x_2 - x_1} \qquad \tan\theta = m$$

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

In ΔABC: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $\qquad a^2 = b^2 + c^2 - 2bc \cdot \cos A$

$$\text{Area of } \Delta ABC = \frac{1}{2} ab. \sin C$$

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Angular velocity $= \omega = 2\ \pi\ n$ where n = rotation frequency

Angular velocity $= \omega = 360°\ n$ where n = rotation frequency

Circumferential velocity $= v = \pi D n$ where D = diameter and n = rotation frequency

Circumferential velocity $= v = \omega\ r$ where ω = angular velocity and r = radius

Arc length $= s = r\theta$ where r = radius and θ = central angle in radians

Area of a sector $= \frac{r\,s}{2}$ where r = radius, s = arc length

Area of a sector $= \frac{r^2\,\theta}{2}$ where r = radius and θ = central angle in radians

$4h^2 - 4d\,h + x^2 = 0$ where h = height of segment, d = diameter of circle and x = length of chord

$A_T = a\left(m_1 + m_2 + m_3 + ... + m_n\right)$ where $a =$ width of equal parts, $m_1 = \frac{o_1 + o_2}{2}$ $o_n = n^{th}$ ordinate and n = number of ordinates

OR

$A_T = a\left(\frac{o_1 + o_n}{2} + o_2 + o_3 + ... + o_{n-1}\right)$ where $a =$ width of equal parts, $o_n = n^{th}$ ordinate and n = number of ordinates

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TECHNICAL MATHEMATICS

PRACTICAL ASSESSMENT TASK 3

GRADE 12

2026

MARKS: **30**

TIME: **2 hours**

SURNAME AND NAME	

SCHOOL	

This task consists of 9 pages (including the cover page) and a 2-page information sheet.

PRACTICAL ASSESSMENT TASK 3 (Individual task)

TOPIC: TRIGONOMETRY – THE COSINE RULE

AIM:

To investigate the cosine rule and apply trigonometry in real life context

INSTRUCTIONS AND INFORMATION

1. This PAT consists of TWO activities.
2. Answer ALL the activities.
3. Resources required are calculators and mathematical sets.
4. Clearly show ALL calculations, diagrams, etc. that you have used in determining your answers.

ACTIVITY 1

INVESTIGATING THE COSINE RULE

1.1 Draw THREE triangles.

TRIANGLE 1 should be an acute-angled triangle KLM.
TRIANGLE 2 should be an obtuse-angled triangle PQR.

TRIANGLE 3 should be a right-angled triangle ABC with $\hat{B} = 90°$.

Label the angles and sides of each triangle.

Solution	Marks
TRIANGLE 1	

Solution	Marks
TRIANGLE 2	

Solution	Marks
TRIANGLE 3	
	(3)

1.2 Use a protractor to measure the angles and a ruler to measure the magnitude of the sides (in centimetres) of the triangles drawn above and complete the following tables.

Solution	Marks
TRIANGLE 1	(3)

Size of angles in degrees	Magnitude/Length of sides in centimetres	Convert magnitude of sides to metres (round off to 4 decimal places)
$\hat{K} =$	$k =$	$k =$
$\hat{L} =$	$l =$	$l =$
$\hat{M} =$	$m =$	$m =$

Solution	Marks
TRIANGLE 2	(3)

Size of angles in degrees	Magnitude/Length of sides in centimetres	Convert magnitude of sides to metres (round off to 4 decimal places)
$\hat{P} =$	$p =$	$p =$
$\hat{Q} =$	$q =$	$q =$
$\hat{R} =$	$r =$	$r =$

Solution	Marks
TRIANGLE 3	(3)

Size of angles in degrees	Magnitude/Length of sides in centimetres	Convert magnitude of sides to metres (round off to 4 decimal places)
$\hat{A} =$	$a =$	$a =$
$\hat{B} = 90°$	$b =$	$b =$
$\hat{C} =$	$c =$	$c =$

1.3
- Use the measurements in Step 1.2 to verify whether the LHS is approximately equal to the RHS in each of the following.
- Record your answers in the table below.
- Round off your answers to FOUR decimal places.

Solution	**Marks**
	(9)

Triangle 1	**LHS**	**RHS**
	$k^2 =$	$l^2 + m^2 - 2lm\cos K =$
	$l^2 =$	$k^2 + m^2 - 2km\cos L =$
	$m^2 =$	$k^2 + l^2 - 2kl\cos M =$

Triangle 2	**LHS**	**RHS**
	$p^2 =$	$q^2 + r^2 - 2qr\cos P =$
	$q^2 =$	$p^2 + r^2 - 2pr\cos Q =$
	$r^2 =$	$p^2 + q^2 - 2pq\cos R =$

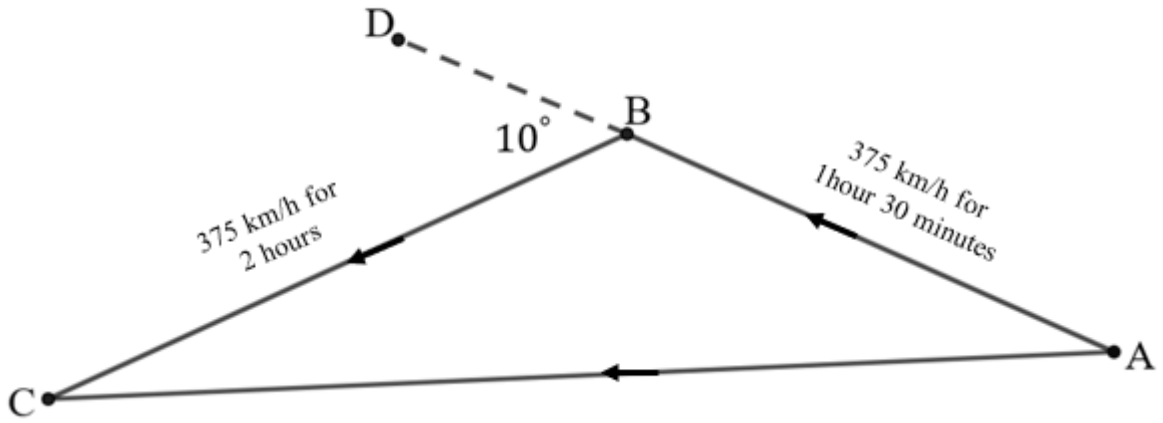
Triangle 3	**LHS**	**RHS**
	$a^2 =$	$b^2 + c^2 - 2bc\cos A =$
	$b^2 =$	$a^2 + c^2 - 2ac\cos B =$
	$c^2 =$	$a^2 + b^2 - 2ab\cos C =$

1.4 Based on your observations in Step 1.3, describe in words the relationship between the sides and angles of a triangle.

Solution	**Marks**
	(3)
	[24]

ACTIVITY 2

A pilot flies in a straight path from point A to point B for 1 hour 30 minutes, at a constant velocity of 375 km/h. At point B, he changes course 10° **south of west** and flies for 2 hours at the same speed, reaching point C. Points A, B, and C lie on the same horizontal plane.



2.1 Determine the straight-line distance from point A to point C.

Show ALL calculations.

Solution	Marks
	(4)

2.2 Hence, determine the size of $\hat{A}$.

Solution	Marks
	(4)
	[6]

TOTAL: 30

INFORMATION SHEET: TECHNICAL MATHEMATICS

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad x = -\frac{b}{2a} \qquad y = \frac{4ac - b^2}{4a}$$

$$a^x = b \Leftrightarrow x = \log_a b, \quad a > 0,\ a \neq 1 \text{ and } b > 0$$

$$A = P(1 + ni) \qquad A = P(1 - ni) \qquad A = P(1+i)^n \qquad A = P(1-i)^n$$

$$i_{eff} = \left(1 + \frac{i}{m}\right)^m - 1$$

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$$\int k x^n \, dx = k \cdot \frac{x^{n+1}}{n+1} + C \ , \ n \neq -1$$

$$\int \frac{k}{x} dx = k \cdot \ln x + C, \ \ x > 0$$

$$\int k a^{nx} \, dx = k \cdot \frac{a^{nx}}{n \ln a} + C \ , \ a > 0$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \qquad M\left(\frac{x_2 + x_1}{2} ; \frac{y_2 + y_1}{2}\right)$$

$$y = mx + c \qquad y - y_1 = m(x - x_1) \qquad m = \frac{y_2 - y_1}{x_2 - x_1} \qquad \tan\theta = m$$

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

$$\text{In } \Delta ABC: \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \qquad a^2 = b^2 + c^2 - 2bc \cdot \cos A$$

$$\text{Area of } \Delta ABC = \frac{1}{2} ab. \sin C$$

$$\sin^2\theta + \cos^2\theta = 1 \qquad 1 + \tan^2\theta = \sec^2\theta \qquad 1 + \cot^2\theta = \text{cosec}^2\theta$$

π rad $= 180°$

Angular velocity $= \omega = 2\ \pi\ n$ where n = rotation frequency

Angular velocity $= \omega = 360°\ n$ where n = rotation frequency

Circumferential velocity $= v = \pi D n$ where D = diameter and n = rotation frequency

Circumferential velocity $= v = \omega\ r$ where ω = angular velocity and r = radius

Arc length $= s = r\theta$ where r = radius and θ = central angle in radians

Area of a sector $= \frac{r\,s}{2}$ where r = radius, s = arc length

Area of a sector $= \frac{r^2\,\theta}{2}$ where r = radius and θ = central angle in radians

$4h^2 - 4d\,h + x^2 = 0$ where h = height of segment, d = diameter of circle and x = length of chord

$A_T = a\left(m_1 + m_2 + m_3 + ... + m_n\right)$ where $a =$ width of equal parts, $m_1 = \frac{o_1 + o_2}{2}$ $o_n = n^{th}$ ordinate and n = number of ordinates

OR

$A_T = a\left(\frac{o_1 + o_n}{2} + o_2 + o_3 + ... + o_{n-1}\right)$ where $a =$ width of equal parts, $o_n = n^{th}$ ordinate and n = number of ordinates

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