

Aligned to DBE  
Revised ATPs

# Mathematics

## Navigation pack

**FET PHASE**  
**GRADE 11**

 **Platinum**

 **Achieve!**

**CLASSROOM**  
**MATHEMATICS**



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Mathematics Grade 11 Navigation Pack

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# Dear Teacher

The National State of Disaster due to the COVID-19 pandemic has resulted in the disruption of Education in South Africa and the loss of valuable teaching time and disruption of the school calendar.

As a result of this, the DBE has created and released revised Annual Teaching Plans (ATPs) to assist schools and teachers in ensuring the 2021 school year is completed. The 2021 ATPs are based on the revised ATPs that were developed in 2020. It is important to note that fundamental and core topics are retained in the 2021 ATPs. Some of the strategies that have been used in the process of developing the 2021 DBE ATPs are:

- reduction of content covered in certain topics
- merging of topics
- deleting topics
- revising the assessment guidelines
- reduction in teaching time for certain topics
- resequencing of topics/concepts

At Pearson South Africa, we believe that education is the key to every individual's success. To ensure that despite the challenges, teachers and learners can meet all the necessary learning outcomes for the year, we have created the Navigation Guide, a free resource to support teachers and learners during this challenging time.

The Navigation Pack aims to summarise and highlight the changes in the 2021 DBE ATP and provide teachers and learners with worksheets that focus on impacted topics in the curriculum.

Due to resequencing of topics, the order of topics in the textbook that is currently used in the classroom may not be aligned to the new sequence of topics in the ATP. The Navigation Pack has a set of assessments based on the Section 4 changes and the revised assessment guidelines.

# COVID-19 safety guidelines for teachers and learners

## Gatherings at school

Where schools are open for learning, it is up to management to take decisive action to ensure sites are not simultaneously used for other functions such as shelters or treatment units in order to reduce the risk.

### Implement social distancing practices that may include:



- A staggered timetable, where teachers and learners do not arrive/leave at the same time for the beginning and end of the school day.
- Cancelling any community meetings/events such as assemblies, cake sales, market day, tuckshop, after-care classes, matric dance, Eisteddfod and other events.
- Cancelling any extra-mural activities such as ballet classes, swimming lessons, sport games, music class and other events that create a crowd gathering.
- Teaching and modeling creating space and avoiding unnecessary touching.
- Limiting movement and interaction between classes.
- Schools with an established feeding scheme plan are to ensure that hygiene and social distancing is always implemented. Teachers and staff members assisting with food distribution are to wear masks, sanitise prior to issuing food items and learners are to stand 1,5m apart in the queue.

**Wear a mask at all times.**



## 1. Restrooms/toilets

### Hand washing

Washing hands with soap and water  or using alcohol-based hand sanitisers  is one of the most important ways to help everybody stay healthy at school. Critical to this is preparing and maintaining handwashing stations with soap and water at the toilet and in each classroom.



Teachers and learners should always wash their hands after:

- eating
- entering the classroom
- using the toilet
- blowing your nose or coughing
- touching tears, mucous, saliva, blood or sweat.

## 2. Premises and Classroom setting

When schools open, classroom settings should be altered in order to promote hygiene, safety and social distancing.

### Changed classroom settings may include:

- Cleaning and disinfecting school buildings, classrooms and especially sanitation of facilities at least once a day, particularly surfaces that are touched by many people (railings, lunch tables, sports equipment, door and window handles, toys, teaching and learning tools etc.).
- Ensure the proper ventilation and fresh flow of air through classrooms.
- Providing learners with vital information about how to protect themselves by incorporating the importance of hygiene, handwashing and other measures of protecting themselves, into the lessons.
- Promoting best handwashing and hygiene practices and providing hygiene supplies.

- Prepare and maintain handwashing stations with soap and water, and if possible, place alcohol-based hand sanitisers in each classroom, at entrances and exits, and near lunchrooms and toilets.



- Ensure teachers and learners wear a mask at all times.



### Social distancing

- Space the learners out in the classroom (or outdoors) – try to keep learners separated by a minimum of 1,5m.



- Create space for learner's desks to be at least 1,5m apart

- Learners should not share cups, eating utensils, or food
- Do not let learners eat items that fall on the floor or chew on pencils or other objects

- Learners are not to exceed 30 per class or 50% of original class size



- Avoid close contact, like shaking hands, hugging or kissing




### 3. Social behaviour

It is extremely vital during a pandemic that focus is not only directed towards optimal physical health and hygiene but finding ways to facilitate mental health support.

- Treat everybody with respect and empathy – no teasing about COVID-19.
- Encourage kindness towards each other and avoid any stereotyping when talking about the virus.
- Stay home if you have a temperature or are ill.
- Do not touch people who are ill, but be empathetic.


**Wear a mask at all times.**



## How to use this Navigation Pack

**Revised DBE Teaching Plan:** Comprehensive summary of the CAPS topics according to the revised ATPs.

**Navigation Plan:** Link to the resources in the Navigation Pack.

REVISED DBE ANNUAL TEACHING PLAN				NAVIGATION PLAN	
TOPIC	CONTENT SPECIFIC CONCEPTS	UNIT	TIME	LINKS TO PEARSON NAVIGATION PACK	PAGE REFERENCE
FUNCTIONS: TROGONOMETRIC FUNCTIONS	Sketching. The effect of parameters $a, p$ and $k$ on: $y = a \sin k(x + p)$ $y = a \cos k(x + p)$ $y = a \tan k(x + p)$	Unit 1: Revision of trigonometric graphs using point-by-point plotting			
		Unit 2: The effects of the parameter $k$ on some trigonometric functions			
		Unit 3: Horizontal shifts			
		Unit 4: Determine the equations of trigonometric graphs			
		Unit 5: Sketching graphs which have a change in period and a horizontal shift			
REVISION					
ASSESSMENTS	Task 3: Assignment				
	Task 4: Test			Navigation Pack: Term 2 Control Test Exemplar	Page 41 – 44 Page 66 – 69
 <b>TOTAL WEEKS = 10</b>					

<sup>+9</sup> June examination has been replaced with a controlled test. The three weeks normally allocated to June examinations has been removed to create more time for deeper learning and to ensure the topics that were trimmed or removed in the previous year are covered in grade 11. (DBE Circular S13 of 2020, Paragraph 6g)

Assessments for the Term as per the revised ATPs and the Section 4 amendments.

Link to a targeted worksheet in the Navigation Pack, that focus on impacted or challenging topics in the curriculum.

Footnotes provide any additional information.

Link to an exemplar assessment in the Navigation Pack, that was created with Section 4 and curriculum changes in mind.



# Navigation Guide

## Mathematics<sup>\*\*1</sup>

TERM	TOPIC	TIME (WEEKS)
TERM 1	Exponents and surds	2
	Equations and inequalities	3
	Euclidean Geometry	3
	Trigonometry (reduction formulae, graphs, equations)	2
TERM 2	Trigonometric equations	1
	Analytical Geometry	3
	Number patterns	2
	Functions	4
TERM 3	Trigonometry (Sine, Cosine and area rules)	3
	Measurement	2
	Statistics	3
	Probability	2
TERM 4	Euclidean Geometry	2
	Finance, growth and decay	3
	Revision	1
	Examination	3

## Programme of Assessment<sup>\*\*2</sup>

TERM 1	TERM 2	TERM 3	TERM 4
Task 1 Investigation / Project ( <b>15%</b> )	Task 3 Assignment ( <b>15%</b> )	Task 5 Test ( <b>10%</b> )	Task 7 Test ( <b>10%</b> )
Task 2 Test ( <b>10%</b> )	Task 4 Test ( <b>10%</b> )	Task 6 Test ( <b>10%</b> )	Final Examination
<b>For reporting</b> 25% inv/pro 75% Test	<b>For reporting</b> 25% assignment 75% Test	<b>For reporting</b> 50% Test 50% Test	

<sup>\*\*1</sup> No important aspect in Mathematics curriculum is compromised.

<sup>\*\*2</sup> The amended School Based Assessment (SBA) is aligned to the content and time available. Informal tasks and activities should be used as assessment for learning, to prepare for formal assessment.

REVISED DBE ANNUAL TEACHING PLAN			NAVIGATION PLAN		
TOPIC	CONTENT SPECIFIC CONCEPTS	UNIT	TIME	LINKS TO PEARSON NAVIGATION PACK	PAGE REFERENCE
EXONENTS AND SURDS (2 WEEKS)	Simplify expressions and solve equations using the laws of exponents for rational exponents where: $x^p = \sqrt[q]{x^p}$ ; $x > 0$ ; $q > 0$ .	Unit 1: Laws of exponents (revision)	2 weeks		
	Add, subtract, multiply and divide simple surds.	Unit 2: Simplify expressions with rational exponents			
	Solve simple equations involving surds.	Unit 3: Solve equations with rational exponents			
		Unit 4: Surds			
REVISION					
ASSESSMENTS					
EQUATIONS AND INEQUALITIES (3 WEEKS)	Complete the square.	Unit 1: Completing the square	3 weeks		
	Solve quadratic equations (by factorization and by using the quadratic formula).	Unit 2: Quadratic equations			
	Solve quadratic inequalities in one unknown.	Unit 3: Quadratic inequalities			
	Equations in two unknowns (simultaneous equations).	Unit 4: Equations in two unknowns, one of which is linear and the other quadratic			
	Nature of roots.	Unit 5: Nature of roots			
REVISION					
ASSESSMENTS					


NB: It is recommended that the solving of equations in two unknowns is important to be used in other equations like hyperbola-straight line as this is normal in the case of graphs.

Term 1

REVISED DBE ANNUAL TEACHING PLAN		NAVIGATION PLAN		
TOPIC	CONTENT SPECIFIC CONCEPTS	UNIT	TIME	
			LINKS TO PEARSON NAVIGATION PACK	
			PAGE REFERENCE	
EUCLIDEAN GEOMETRY AND MEASUREMENT* <sup>1</sup> (3 WEEKS)	Explore the various Grade 11 Circle Geometry theorems investigative. Formalise the theorems. Accept results established in earlier grades as axioms and also that a tangent to a circle is perpendicular to the radius, drawn to the point of contact. Then investigate and prove the theorems of the geometry of circles: formal proofs required* <sup>2</sup>	Unit 1: Geometry revision	3 weeks	
		Unit 2: Circles, perpendicular lines through the centre, chords and midpoints <ul style="list-style-type: none"> <li>The line drawn from the centre of a circle perpendicular to a chord bisects the chord.</li> <li>The perpendicular bisector of a chord passes through the centre of the circle.</li> </ul>		
		Unit 3: Angle at centre theorem and cyclic quadrilaterals <ul style="list-style-type: none"> <li>The angle subtended by an arc at the centre of a circle is double the size of the angle subtended by the same arc at the circle (on the same side of the chord as the centre).</li> <li>Angles subtended by a chord of the circle, on the same side of the chord, are equal.</li> <li>The opposite angles of a cyclic quadrilateral are supplementary.</li> </ul>		
		Unit 4: Tangents <ul style="list-style-type: none"> <li>Two tangents drawn to a circle from the same point outside the circle are equal in length.</li> <li>The angle between the tangent to a circle and the chord drawn from the point of contact is equal to the angle in the alternate segment.</li> </ul>		
REVISION				
ASSESSMENTS				

\*<sup>1</sup> Euclidean Geometry has been moved from Term 3 to Term 1

\*<sup>2</sup> Formal proofs are required in this section.

TOPIC	REVISED DBE ANNUAL TEACHING PLAN		NAVIGATION PLAN	
	CONTENT SPECIFIC CONCEPTS	UNIT	TIME	LINKS TO PEARSON NAVIGATION PACK
TRIGONOMETRY* <sup>3</sup> (2 WEEKS)	Trigonometry (reduction formulae, graphs, equations). Derive and use the identities Derive and use reduction formulae to simplify expressions. Determine for which values of a variable an identity holds.	Unit 1: Revision of Grade 10 trigonometry  Unit 2: Identities $\tan \theta = \frac{\sin \theta}{\cos \theta}$ ; $\theta \neq k \cdot 90^\circ$ ; $k$ an odd integer; and $\sin^2 \theta + \cos^2 \theta = 1$ .  Unit 3: Reduction formulae Simplify the following expressions: $\sin(90^\circ \pm \theta)$ ; $\cos(90^\circ \pm \theta)$ ; $\sin(180^\circ \pm \theta)$ ; $\cos(180^\circ \pm \theta)$ and $\tan(180^\circ \pm \theta)$ ; $\sin(360^\circ \pm \theta)$ ; $\cos(360^\circ \pm \theta)$ and $\tan(360^\circ \pm \theta)$ ; $\sin(-\theta)$ ; $\cos(-\theta)$ and $\tan(-\theta)$ .	2 weeks	
ASSESSMENTS	Task 1: Investigation or project Task 2: Control Test			
 TOTAL WEEKS = 10				


\*<sup>3</sup> Trigonometry has been moved from Term 2 to Term 1.

Term 1

REVISED DBE ANNUAL TEACHING PLAN			NAVIGATION PLAN		
TOPIC	CONTENT SPECIFIC CONCEPTS	UNIT	TIME	LINKS TO PEARSON NAVIGATION PACK	PAGE REFERENCE
TRIGONOMETRY (CONTINUED) (1 WEEK)	Determine the general solutions of trigonometric equations.	Unit 4: Trigonometric equations – specific and general solutions	1 week		
REVISION					
ASSESSMENTS					
ANALYTICAL GEOMETRY* <sup>4</sup> (3 WEEKS)	Revision	Distance between the two points. Gradient of the line segment connecting the two points (and from that identify parallel and perpendicular lines). Coordinates of the mid-point of the line segment joining the two points. Unit 1: The equation of a straight line Unit 2: Inclination of a line where $m = \tan \theta$ is the gradient of the line ( $0^\circ \leq \theta \leq 180^\circ$ ).	3 weeks		
REVISION					
ASSESSMENTS					
NUMBER PATTERNS* <sup>5</sup> (2 WEEKS)	Revise: Linear Patterns Quadratic Patterns General term	Unit 1: Linear patterns Unit 2: Quadratic patterns Investigate number patterns leading to those where there is a constant second difference between consecutive terms, and the general term is therefore quadratic.	2 weeks		
REVISION					
ASSESSMENTS					

\*<sup>4</sup> Analytical Geometry has been moved from Term 1 to Term 2.

\*<sup>5</sup> Number Patterns has been moved from Term 1 to Term 2.

REVISED DBE ANNUAL TEACHING PLAN			NAVIGATION PLAN		
TOPIC	CONTENT SPECIFIC CONCEPTS	UNIT	TIME	LINKS TO PEARSON NAVIGATION PACK	PAGE REFERENCE
FUNCTIONS: EFFECTS OF PARAMETERS* <sup>6</sup> (4 WEEKS)	Functions: Parabola; Hyperbola; Exponential. Average gradient between two points on a curve.	Unit 1: The effects of the parameters $a$ , $p$ and $q$ on parabolas	4 weeks		
		Unit 2: The effects of the parameters $a$ , $p$ and $q$ on hyperbolas			
		Unit 3: The effects of the parameters $a$ , $p$ and $q$ on exponential graphs			
		Unit 4: Real life applications			
		Unit 5: The average gradient between two points on a curve			
REVISION					
ASSESSMENTS					
FUNCTIONS: TROGNOMETRIC FUNCTIONS	Sketching. The effect of parameters $a$ , $p$ and $k$ on: $y = a \sin k(x + p)$ $y = a \cos k(x + p)$ $y = a \tan k(x + p)$	Unit 1: Revision of trigonometric graphs using point-by-point plotting			
		Unit 2: The effects of the parameter $k$ on some trigonometric functions			
		Unit 3: Horizontal shifts			
		Unit 4: Determine the equations of trigonometric graphs			
		Unit 5: Sketching graphs which have a change in period and a horizontal shift			
REVISION					
ASSESSMENTS					
ASSESSMENTS	Task 3: Assignment				
	Task 4: Test			* <sup>7</sup> Navigation Pack: Term 2 Control Test Exemplar	Page 42 – 45 Page 66 – 69
 <b>TOTAL WEEKS = 10</b>					

\*<sup>6</sup> Platinum textbook has separated Functions (Hyperbola, Parabola and Exponential) and Trigonometric functions into 2 topics

\*<sup>7</sup> June examination has been replaced with a controlled test. The three weeks normally allocated to June examinations has been removed to create more time for deeper learning and to ensure the topics that were trimmed or removed in the previous year are covered in grade 11. (DBE Circular S13 of 2020, Paragraph 6g)

Term 3

REVISED DBE ANNUAL TEACHING PLAN			NAVIGATION PLAN		
TOPIC	CONTENT SPECIFIC CONCEPTS	UNIT	TIME	LINKS TO PEARSON NAVIGATION PACK	PAGE REFERENCE
TRIGONOMETRY: SINE, COSINE AND AREA RULES (2 WEEKS)	Trigonometry (sine, cosine and area rules)	Unit 1: Proof and application of the sine, cosine and area rules Unit 2: Two-dimensional problems using the sine, cosine and area rules	2 weeks		
REVISION					
ASSESSMENTS					
MEASUREMENT*8 (2 WEEKS) (extra week to cover grade 10 content)	Volume and surface area of right-prisms and cylinders	Unit 1: Revision of Grade 10 measurement Revise the volume and surface areas of right-prisms and cylinders. Study the effect on volume and surface areas when multiplying any dimension by a constant factor $k$ .	2 weeks		
REVISION					
ASSESSMENTS					

\*8 No trimmed content




REVISED DBE ANNUAL TEACHING PLAN			NAVIGATION PLAN		
TOPIC	CONTENT SPECIFIC CONCEPTS	UNIT	TIME	LINKS TO PEARSON NAVIGATION PACK	PAGE REFERENCE
STATISTICS* <sup>9</sup> (3 WEEKS) (extra week to cover grade 10 content)	Revision	Revise measures of central tendency in ungrouped data. Measures of central tendency in grouped data: calculation of mean estimate of grouped and ungrouped data and identification of modal interval and interval in which the median lies. Revision of range as a measure of dispersion and extension to include percentiles, quartiles, inter-quartile and semi-inter-quartile range. Five number summary: maximum, minimum, quartiles and box-and-whisker diagram. Use the statistical summaries (measures of central tendency and dispersion), and graphs to analyse and make meaningful comments on the context associated with the given data.	3 weeks	Navigation Pack: Targeted Worksheet 1	Page 24 – 27 Page 35 – 36
		Unit 1: Histograms and frequency polygons			
		Unit 2: Ogive curves			
		Unit 3: Variance and standard deviation of ungrouped data			
		Unit 4: Symmetric and skewed data			
		Unit 5: Identification of outliers			
REVISION					
ASSESSMENTS					

\*<sup>9</sup> Statistics has been moved from Term 4 to Term 3.

Term 3

REVISED DBE ANNUAL TEACHING PLAN			NAVIGATION PLAN		
TOPIC	CONTENT SPECIFIC CONCEPTS	UNIT	TIME	LINKS TO PEARSON NAVIGATION PACK	PAGE REFERENCE
PROBABILITY* <sup>10</sup> (3 WEEKS) (extra week to cover grade 10 content) Cover grade 10 content simultaneously with grade 11.		Unit 1: Addition and complementary rules; dependent and independent events Grade 10 revision: What is probability? Probability Notation Unit 2: Venn diagrams Grade 10 revision Unit 4: Contingency tables	3 weeks Navigation Pack: Term 3 Control Test 2 Exemplar	Navigation Pack: Targeted Worksheet 2	Page 28 – 31 Page 37 – 38
ASSESSMENTS	Task 5: Test Task 6: Test			Navigation Pack: Term 3 Control Test 1 Exemplar Term 3 Control Test 2 Exemplar	Page 46 – 48 Page 49 – 51 Page 70 – 71 Page 72 – 74
TOTAL WEEKS = 10					

\*<sup>10</sup> No trimmed content

REVISED DBE ANNUAL TEACHING PLAN			NAVIGATION PLAN		
TOPIC	CONTENT SPECIFIC CONCEPTS	UNIT	TIME	LINKS TO PEARSON NAVIGATION PACK	PAGE REFERENCE
PROBABILITY (CONTINUED) (1 WEEK)		Unit 3: Using tree diagrams to solve problems regarding events not necessarily independent	1 week		
REVISION		Grade 10 revision			
ASSESSMENTS					
FINANCE, GROWTH AND DECAY <sup>*11</sup> (3 WEEKS)	Revision	Use the simple and compound growth formulae to solve problems, including interest, hire purchase, inflation, population growth and other real-life problems. Understand the implication of fluctuating foreign exchange rates (e.g., on the petrol price, imports, exports, overseas travel).	3 weeks	Navigation Pack: Targeted Worksheet 3	Page 32 – 34 Page 39–40
REVISION		Unit 1: Simple and compound decay			
ASSESSMENTS		Unit 2: The effect of different periods of compound growth and decay			
ASSESSMENTS	Task 7: Test Final Examination			Navigation Pack: Term 4 Control Test Exemplar Navigation Pack: Exemplar Examinations	Page 52 – 54 Page 75 – 76 Page 55 – 65 Page 77 – 88
 <b>TOTAL WEEKS = 4</b>					

<sup>\*11</sup> Moved from Term 3 to Term 4  
\* No trimmed content

# Targeted Worksheets

**Targeted Worksheet 1**

TARGETED WORKSHEET	TOPIC IN CAPS
1	Statistics
2	Probability
3	Financial Mathematics

## Targeted Worksheet 1

Topic: Statistics: Measures of central tendency and dispersion

### Content summary

#### Grade 10 content (Question 1 and Question 2)

- Revise measures of central tendency in ungrouped data.
- Measures of central tendency in grouped data: calculation of mean estimate of grouped and ungrouped data and identification of modal interval and interval in which the median lies.
- Revision of range as a measure of dispersion and extension to include percentiles, quartiles, interquartile and semi-interquartile range.
- Five number summary (maximum, minimum and quartiles) and box-and-whisker diagram (Question 3).
- Use the statistical summaries (measures of central tendency and dispersion), and graphs to analyse and make meaningful comments on the context associated with the given data.

#### Grade 11 Content (Question 3 and Question 4)

- Frequency polygons
- Ogives (cumulative frequency curves)
- Variance and standard deviation of ungrouped data
- Symmetric and skewed data
- Identification of outliers

Question 1 and 2 covers Grade 10 content, it tests the learners' ability to calculate measures of central tendency in ungrouped data and grouped data. In Question 2, learners are expected to calculate the mean using the table and answer questions that test understanding.

Question 3 tests the learners' ability to work with ungrouped data; how to draw a box-and-whisker diagram, calculate the mean/range and comment on the skewness of the data. Learners should be able to use a calculator to work out the standard deviation.

Question 4 tests the learners' ability to read and understand an ogive curve.

**Targeted Worksheet 1**

**Time: 60 minutes**

**Name:**

**Surname:**

Topic: Statistics: Measures of central tendency and dispersion

**This paper consists of 4 questions.**

**Instructions**

**Read the following instructions carefully before answering the questions**

1. Answer ALL the questions.
2. Clearly show ALL calculations.
3. You may use a non-programmable scientific calculator.
4. Write neatly and legibly.

**Question 1**

The data set gives the heights in cm of seedlings, 6 weeks after germinating:

29	38	40	33	36	29	40	39	328	29	39	336
----	----	----	----	----	----	----	----	-----	----	----	-----

Calculate the:

- 1.1 mean. (2)
- 1.2 median. (2)
- 1.3 mode for the data set. (2)
- 1.4 Which measure of central tendency is the most appropriate to describe the dataset? (2)

**[8]**

## Targeted Worksheet 1

### Question 2

In a traffic survey, 80 motorists were asked what distance they drove to work daily. The table shows the results.

Distance in km	Frequency	Midpoint	frequency × midpoint
$0 < x \leq 5$	7		
$5 < x \leq 10$	8		
$10 < x \leq 15$	12		
$15 < x \leq 20$	16		
$20 < x \leq 25$	12		
$25 < x \leq 30$	13		
$30 < x \leq 35$	5		
$35 < x \leq 40$	4		
$40 < x \leq 45$	3		
<b>Total</b>			

- 2.1 Copy and complete the table. (4)
- 2.2 Calculate an approximate mean for the data. (3)
- 2.3 Find the median and modal classes for the data. (4)
- 2.4 What percentage of the motorists drove
  - 2.4.1 less than or equal to 15 km? (2)
  - 2.4.2 more than 35 km? (2)
  - 2.4.3 between 15 km and 35 km daily? (2)

**[17]**

### Question 3

The table below shows the marks (out of 80) obtained in a Mathematics test by a class of nine learners.

20	28	36	41	62	69	75	75	80
----	----	----	----	----	----	----	----	----

- 3.1 Calculate the range of the data. (2)
- 3.2 Calculate the standard deviation of the data. (2)
- 3.3 Determine the median of the data. (1)
- 3.4 Determine the interquartile range of the data. (3)
- 3.5 Draw a box-and-whisker diagram for the data above. (3)
- 3.6 Describe the skewness of the data. (1)
- 3.7 Identify outliers, if any exists, for the above data. (1)
- 3.8 Calculate the mean of the data. (2)
- 3.9 Showing calculations, state how many of the numbers lie within one standard deviation of the mean. (3)

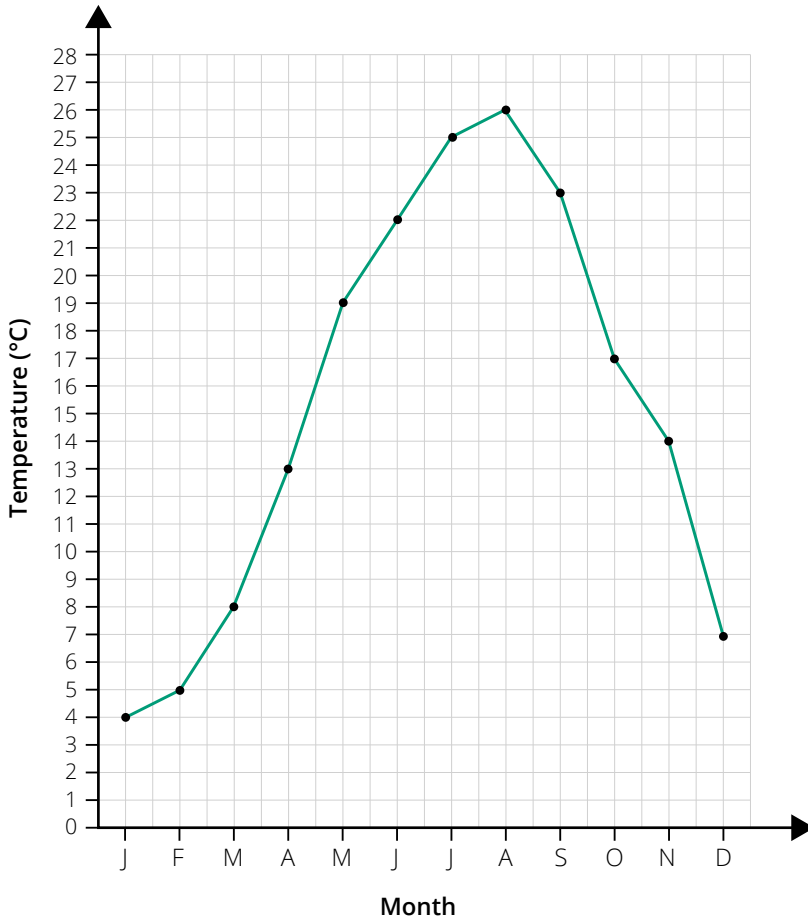
**[18]**



Targeted Worksheet 1

Question 4

The graph below shows the monthly maximum temperatures in a town:



- 4.1 Write down the range of the monthly maximum temperatures. (2)
- 4.2 Calculate the mean monthly maximum temperature. (2)
- 4.3 It is predicted that global warming is likely to increase the town’s monthly maximum temperature by 4°C in December, January and February. The temperature will increase by 1°C in the other months of the year. Calculate the new mean for the data, taking into account global warming. (3)

[7]

**Total: [50]**

## Targeted Worksheet 2

Topic: Probability: Ability to do calculations involving Venn diagrams and probability

### Content summary

#### Grade 10 content

The use of Venn diagrams to solve probability problems, deriving and applying the following for any two events in a sample space  $S$ :

- $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ ;
- $A$  and  $B$  are mutually exclusive if  $P(A \text{ and } B) = 0$ ;
- $A$  and  $B$  are complementary if they are mutually exclusive; and
- if  $P(A) + P(B) = 1$ , then  $P(B) = P(\text{not } A) = 1 - P(A)$

#### Grade 11 content

Using Venn diagrams as the focus, learners are expected to know:

- the addition rule for mutually exclusive events:  $P(A \text{ or } B) = P(A) + P(B)$
- the complementary rule:  $P(\text{not } A) = 1 - P(A)$
- and the identity:  $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

The use of Venn diagrams to solve probability problems, deriving and applying formulae for any three events  $A$ ,  $B$  and  $C$  in a sample space  $S$ .

It is important that learners understand that probability is from 0 to 1 or represented as a percentage.

The probability of an event can be calculated as follows:

- Probability of event =  $\frac{\text{number of outcomes in the event}}{\text{total number of outcomes in the experiment (sample space)}}$

**Targeted Worksheet 2**

**Time: 60 minutes**

**Name:**

**Surname:**

Topic: Probability: Ability to do calculations involving Venn diagrams and probability

**This paper consists of 4 questions.**

**Instructions**

**Read the following instructions carefully before answering the questions**

1. Answer ALL the questions.
2. Clearly show ALL calculations.
3. You may use a non-programmable scientific calculator.
4. Write neatly and legibly.

**Question 1**

A survey was conducted among Grade 11 learners on the subjects they do at school. The survey revealed the following:

- 8 do all the three subjects of Mathematics, Physics and Accounting.
- 12 do Mathematics and Physics.
- 5 do Physics and Accounting, but not Mathematics.
- $x$  do Mathematics and Accounting, but not Physics.
- 61 do Mathematics.
- 19 do Physics.
- 75 do Accounting.
- 14 do none of the subjects.

- 1.1 Draw a Venn diagram to illustrate the information above. (4)
- 1.2 Calculate the value of  $x$ . (2)
- 1.3 Calculate the probability that a learner, chosen randomly, does only ONE of these subjects. (2)

**[8]**

## Targeted Worksheet 2

### Question 2

The 120 Grade 11 learners at a school have three extramural activities to choose from: hiking, chess and drama. They are allowed to do as many of these activities as they like, so it is possible to do all three, any two or any one activity. They may also choose not to do any extramural activity at all. The following information describes this situation:

- $x$  learners take only drama and chess.
- 32 learners take chess.
- 40 learners take only drama.
- 6 learners take hiking and chess but not drama.
- 17 learners take chess and drama.
- 65 learners take drama.
- 53 learners take hiking.
- 6 learners do not take any extramural activities.

- 2.1 Draw a Venn diagram to represent the information above. (6)
- 2.2 Determine how many learners take only drama and chess (i.e., solve for  $x$ ). (3)
- 2.3 What is the probability that a learner has chosen at random takes all three extramural activities? (2)
- 2.4 What is the probability that a learner chosen at random takes drama or hiking? (3)

**[14]**

### Question 3

A group of 329 people from the Western Cape speak English, Afrikaans or Xhosa, or combinations of the three languages. The results of a language survey conducted in this group were stored on Larry Loskop's computer, but unfortunately his files were corrupted. The following facts are all that he has left:

- 82 people in the survey speak only English and Afrikaans.
- 8 people speak only Xhosa and Afrikaans.
- 108 people speak only English.
- 34 people speak Xhosa and English.
- 143 people speak Afrikaans.
- 109 people speak Xhosa.

You decide to let the number of people speaking only English and Xhosa be  $x$ .

- 3.1 Help Larry by drawing a Venn diagram to represent the above information. (6)
- 3.2 Use your Venn diagram to solve for  $x$ . (3)
- 3.3 What is the probability that a person selected at random from the group speaks English, Afrikaans and Xhosa? (2)

**Targeted Worksheet 2**

- 3.4 What is the probability that a person selected at random from the group speaks only one language? (2)
- 3.5 What is the probability that a person selected at random from the group speaks two languages only? (2)

**[15]**

**Question 4**

In a survey, a group of 283 workers were asked which mode of transport they use to get to work. The results of the survey are summarised below.

- $x$  workers take a train, a bus and a taxi to get to work.
- 110 workers take a train and a taxi.
- 38 workers take a taxi and a bus.
- 32 workers take a train and a bus but not a taxi.
- 60 get to work by taxi only.
- 110 workers take a bus.
- 172 workers take a train.

- 4.1 Draw a Venn diagram to represent the information above. (6)
- 4.2 Determine the number of workers who take a train, a bus and a taxi to work (i.e.,  $x$ ). (3)
- 4.3 What is the probability that a worker picked from the sample takes a train and a bus to work? Give your answer as a fraction. (2)
- 4.4 What is the probability that a worker picked from the sample takes a bus but not a train? Give your answer as a fraction. (2)

**[13]**

**Total: [50]**

## Targeted Worksheet 3

Topic: Financial Mathematics: Appreciation and depreciation with change in compounding periods

### Content summary

The compound interest formula (reducing-balance formula) is given by:

$$A = P(1 \pm i)^n$$

where:

- $A$ : final value (accumulated amount)
- $P$ : initial value (principal value)
- $i$ : interest rate
- $n$ : number of times interest will be added (or number of compounding periods)

The interest rate can be compounded in various intervals as illustrated in the table below:

Interval	Number of times in a year
annually	once a year
half-yearly or semi-annually	twice a year
quarterly	four times a year
monthly	twelve times a year

### Questions 1 and 2:

- Determine the value of the accumulated amount/final amount ( $A$ ).
- Determine the value of the principal amount/initial value ( $P$ ).
- Determine the interest rate ( $r$ ).

### Questions 3 and 4:

- Effect of different compounding periods.
- Timeline questions.
- Nominal and effective interest rates.

**Targeted Worksheet 3**

Time: 60 minutes

Name: \_\_\_\_\_

Surname: \_\_\_\_\_

Topic: Financial Mathematics: Appreciation and depreciation with change in compounding periods

**This paper consists of 4 questions.**

### Instructions

**Read the following instructions carefully before answering the questions**

1. Answer ALL the questions.
2. Clearly show ALL calculations.
3. You may use a non-programmable scientific calculator.
4. Write neatly and legibly.

### Question 1

- 1.1 Determining the investment value (accumulated amount):  
Jonathan deposits R3 000 into a bank account. The bank offers an interest rate of 15% p.a. compounded monthly. Calculate the amount that Jonathan will withdraw after 6 years. (3)
- 1.2 Determining the principal amount (initial amount):  
A car has a current value of R250 000. If the value depreciated at 13% p.a. compounded quarterly, calculate the initial value of the car 10 years ago based on a reducing balance method (round off to the nearest rand). (4)
- [7]**

### Question 2

- 2.1 Determining the nominal interest rate ( $r$ ):  
Sipho invested R15 000 in a banking account. After 5 years he withdraws R28 000. Calculate the interest rate (rounded to two decimal places) per annum if it was compounded half-yearly. (5)
- [5]**

## Targeted Worksheet 3

### Question 3

- 3.1 R2 650 was invested in a fund paying  $i\%$  p.a., compounded monthly. After 18 months the fund had grown to a value of R3 004,53. Calculate the interest rate. (5)
- 3.2 Kai bought a new car 4 years ago. He now wants to upgrade to the latest model. Four years ago he invested R60 000 for 4 years at an interest rate of 9,6% p.a., compounded monthly. He will use the investment to pay cash for the new car and use the old car as a trade-in. Calculate the value of his current car if he paid R160 000 for it and it depreciated at 12% p.a. on a reducing balance. Round off the answer to the nearest rand. (2)
- 3.3 Assuming inflation over the 4 years is determined at 9% p.a., calculate the current price of a similar new car. Round off the answer to the nearest rand. (2)
- 3.4 The dealer offers Kai a 12% discount on the price of the new car. Calculate how much cash he must still find to pay for the new car after trading in the old car and withdrawing the investment. (4)
- 3.5 An amount of R25 000 is invested at 7,6% p.a. compounded monthly. After  $2\frac{1}{2}$  years, R10 000 is withdrawn and the interest changes to 8,2% compounded quarterly. Calculate how much will be in the account at the end of 5 years. (4)

**[17]**

### Question 4

- 4.1 Thabo paid R12 000 towards a loan, for 4 years from the date on which the loan was granted. Two years later, he paid off the remaining R8 000. The interest rate was 19% p.a., compounded quarterly for the first 4 years, and then changed to 21% p.a., compounded annually, for the remaining 2 years. Determine the value of the loan that Thabo obtained from the bank. (5)
- 4.2 Asanda inherited R36 000. He invested the money in a savings account paying 9% interest p.a., compounded monthly for the first two years. He then withdrew R10 000 for his studies. At the same time, the interest rate changed to 8,8% p.a., compounded quarterly. Three years later, he deposited a further R2 500 and left his investment to grow for a further four years at the same interest rate. Calculate how much was left in the account at the end of nine years. (7)
- 4.3 Mrs Pillay deposited R240 000 into a fixed-deposit savings account for 5 years. The accumulated amount in the savings account at the end of the 5-year period is R390 000. Calculate the interest rate paid by the bank in each of the following situations:
- 4.3.1 the effective annual interest rate. (3)
- 4.3.2 the nominal interest rate per annum if the interest rate was compounded monthly. (3)
- 4.3.3 the nominal interest rate per annum if the interest was compounded daily. (3)

**[21]**

**Total: [50]**



Targeted Worksheet 1 Answers

Time: 60 minutes

Topic: Statistics

- 1.1 mean =  $\frac{480}{14} = 34,29$  ✓✓ (2)
- 1.2 median =  $\frac{33+36}{2} = 34,5$  ✓✓ (2)
- 1.3 mode = 29 ✓✓ (2)
- 1.4 mean or median are both appropriate ✓✓ (2)

**[8]**

- 2.1 (4)

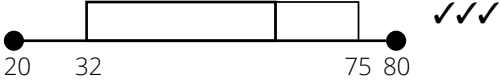
Distance in km	Frequency	Midpoint	frequency × midpoint
$0 < x \leq 5$	7	2,5	17,5
$5 < x \leq 10$	8	7,5	60
$10 < x \leq 15$	12	12,5	150
$15 < x \leq 20$	16	17,5	280
$20 < x \leq 25$	12	22,5	270
$25 < x \leq 30$	13	27,5	357,5
$30 < x \leq 35$	5	32,5	162,5
$35 < x \leq 40$	4	37,5	150
$40 < x \leq 45$	3	42,5	127,5
<b>Total</b>	80 ✓	✓	1 575 ✓✓

- 2.2 mean =  $\frac{1\ 575}{80} = 19,69$  ✓✓✓ (3)
- 2.3 median = occurs between (40)<sup>th</sup> and (41)<sup>st</sup> piece of data. So, the median class interval is  $15 < x \leq 20$  ✓✓
- Modal class interval = highest frequency  
 $15 < x \leq 20$  ✓✓ (4)
- 2.4.1  $\% < 15 = \frac{27}{80} \times 100 = 33,75\%$  ✓✓ (2)
- 2.4.2  $\% > 35 = \frac{7}{80} \times 100 = 8,75\%$  ✓✓ (2)
- 2.4.3  $\% 15 < x \leq 35 = \frac{46}{80} \times 100 = 57,5\%$  ✓✓ (2)

**[17]**

- 3.1  $80 - 20 = 60$  ✓✓ (2)
- 3.2 21,5 ✓✓ (2)
- 3.3 62 ✓ (1)
- 3.4  $Q_2 = Q_3 - Q_1$   
 $Q_1 = \frac{28+36}{2} = 32$  ✓  
 $Q_3 = \frac{75+75}{2} = 75$  ✓  
 $Q_2 = 75 - 32 = 43$  ✓ (3)

### Targeted Worksheet 1 Answers

3.5  (3)

3.6 Skewed to the left. ✓ (1)

3.7 There are no outliers. ✓ (1)

3.8 mean =  $\frac{486}{9} = 54$  ✓✓ (2)

3.9 Numbers between 32,5 ✓ and 75,5 ✓: 6 numbers. ✓ (3)

**[18]**

4.1 Range:  $26\text{ °C} - 4\text{ °C} = 22\text{ °C}$  ✓✓ (2)

4.2 Mean =  $\frac{(4 + 5 + 8 + 13 + 19 + 22 + 25 + 26 + 23 + 17 + 14 + 7)}{12} = \frac{183}{12} = 15,25\text{ °C}$  ✓✓ (2)

4.3 Increase in mean =  $\frac{(3 \times 4) + (9 \times 1)}{12} = 1,75\text{ °C per month}$  ✓✓  
 New mean =  $17\text{ °C}$  ✓ (3)

**[7]**

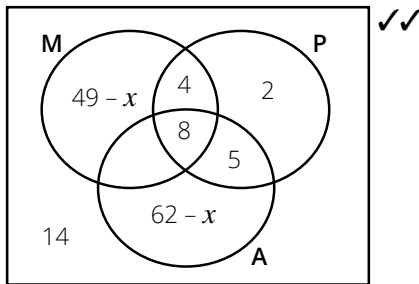
**Total: [50]**

Targeted Worksheet 2 Answers

Time: 60 minutes

Topic: Probability

1.1



Mathematics:  $m + x + 8 + 4 = 61$

$$m = 49 - x \checkmark$$

Accounts:  $x + 8 + 5 + a = 75$

$$a = 62 - x \checkmark$$

(4)

1.2  $49 - x + 4 + 8 + x + 2 + 5 + 62 - x + 14 = 100 \checkmark$

$$x = 44 \checkmark$$

(2)

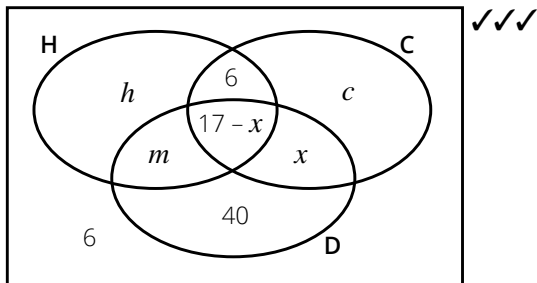
1.3  $18 + 2 + 5 = 25$

Probability =  $\frac{25}{100} = \frac{1}{4} \checkmark \checkmark$

(2)

[8]

2.1



Chess:  $6 + 17 - x + x + c = 32$

$$c = 9 \checkmark$$

Drama:  $m + 17 - x + x + 40 = 65$

$$m = 8 \checkmark$$

Hiking:  $h + 6 + 17 - x + 8 = 53$

$$h = 22 + x \checkmark$$

(6)

2.2  $22 + x + 6 + 9 + 17 - x + x + 40 + 8 + 6 = 120 \checkmark \checkmark$

$$x = 120 - 108 = 12 \checkmark$$

(3)

2.3  $P(\text{all three activities}) = \frac{5}{120} = \frac{1}{24} \checkmark \checkmark$

(2)

2.4  $P(\text{drama or hiking}) = P(D) + P(H) - P(D \text{ and } H)$

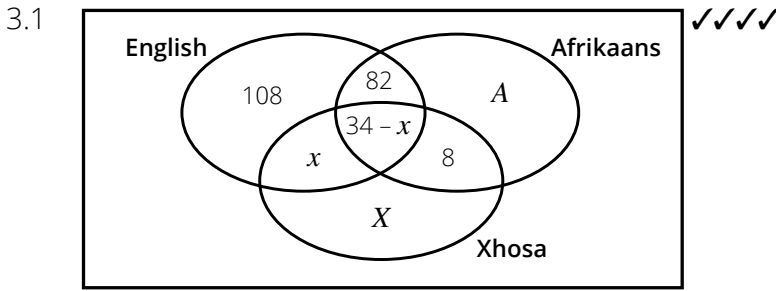
$$P(\text{drama or hiking}) = \frac{65}{120} + \frac{53}{120} - \frac{13}{120} = \frac{105}{120} \checkmark \checkmark$$

$$P(\text{drama or hiking}) = \frac{7}{8} \checkmark$$

(3)

Targeted Worksheet 2 Answers

[14]



Afrikaans:  $A + 82 + 34 - x + 8 = 143$

$A = 19 + x$  ✓

Xhosa:  $X + x + 34 - x + 8 = 109$

$X = 67$  ✓

(6)

3.2  $108 + 82 + 34 - x + x + 8 + 19 + x + 67 = 329$  ✓✓

$x = 11$  ✓

(3)

3.3  $P(\text{English, Afrikaans and Xhosa}) = \frac{34 - 11}{329} = \frac{23}{329}$  ✓✓

(2)

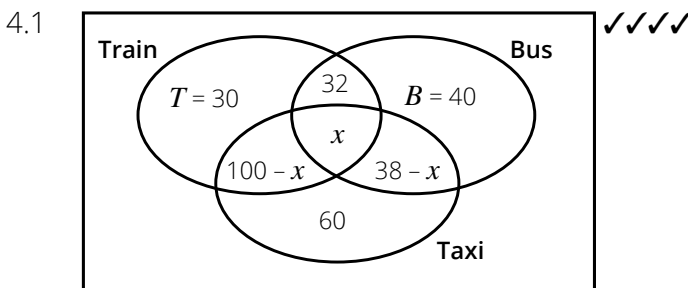
3.4  $P(\text{speaks only one language}) = \frac{108 + 67 + 30}{329} = \frac{205}{329}$  ✓✓

(2)

3.5  $P(\text{speaks two languages only}) = \frac{82 + 8 + 11}{329} = \frac{101}{329}$  ✓✓

(2)

[15]



Bus:  $32 + x + 38 - x + B = 110$

$B = 40$  ✓

Train:  $T + 32 + x + 110 - x = 172$

$T = 30$  ✓

(6)

4.2  $30 + 32 + x + 110 - x + 60 + 38 - x + 40 = 283$  ✓✓

$310 - 283 = x$

$x = 27$  ✓

(3)

4.3  $P(\text{train and a bus}) = \frac{32 + 27}{283} = \frac{59}{283}$  ✓✓

(2)

4.4  $P(\text{bus but not a train}) = \frac{40 + 38 - 27}{283} = \frac{51}{283}$  ✓✓

(2)

[13]

Total: [50]

Targeted Worksheet 3 Answers

Time: 60 minutes

Topic: Financial Mathematics

$$1.1 \quad A = 3\,000 \left(1 + \frac{11,5}{12 \times 100}\right)^{12 \times 6} \checkmark\checkmark$$

$$A = R5\,997,06 \checkmark \quad (3)$$

$$1.2 \quad 250\,000 = P \left(1 - \frac{13}{4 \times 100}\right)^{4 \times 10} \checkmark\checkmark$$

$$P = \frac{250\,000}{\left(1 - \frac{13}{400}\right)^{40}} \checkmark$$

$$1.3 \quad P = R937\,348 \checkmark \quad (4)$$

[7]

$$2.1 \quad 28\,000 = 15\,000(1 + i)^{2 \times 5} \checkmark\checkmark$$

$$\frac{28\,000}{15\,000} = (1 + i)^{10}$$

$$1 + i = \sqrt[10]{\frac{28\,000}{15\,000}} \checkmark$$

$$i = \sqrt[10]{\frac{28\,000}{15\,000}} - 1$$

$$i = 0,0644044$$

$$\frac{r}{2 \times 100} = 0,0644044 \checkmark$$

$$r = 0,0644044 \times 200$$

$$r = 12,88\% \checkmark$$

(5)

[5]

$$3.1 \quad 3\,004,53 = 2\,650 \left(1 + \frac{i}{12}\right)^{18} \checkmark$$

$$\sqrt[18]{3\,004,53 \div 2\,650} = 1 + \frac{i}{12} \checkmark$$

$$i = 0,084 \checkmark$$

The interest rate is 8,4%.  $\checkmark$

(5)

$$3.2 \quad 60\,000(1 - 0,12)^4 \checkmark = R95\,951 \checkmark$$

(2)

$$3.3 \quad 60\,000(1 + 0,09)^4 \checkmark = R225\,853 \checkmark$$

(2)

$$3.4 \quad \text{Price after discount} = 225\,853(0,88) = R198\,750,64 \checkmark$$

$$\text{Investment} = 60\,000 \left(1 + \frac{0,096}{12}\right)^{48} \checkmark = R87\,954,24 \checkmark$$

$$\text{He still needs } R198\,750,64 - 95\,951 - 87\,954,24 = R14\,845,40. \checkmark$$

(4)

$$3.5 \quad \left[25\,000 \left(1 + \frac{0,076}{12}\right)^{30} \checkmark - 10\,000\right] \checkmark \left(1 + \frac{0,082}{4}\right)^{10} \checkmark = R24\,760,75 \checkmark$$

(4)

[17]

$$4.1 \quad Pv = A \left(1 + \frac{i}{m}\right)^{-mn}$$

$$Pv = 8\,000(1 + 0,21)^{-2} \checkmark \left(1 + \frac{0,19}{4}\right)^{-16} \checkmark + 12\,000 \checkmark \left(1 + \frac{0,19}{4}\right)^{-16} \checkmark$$

$$Pv = R8\,311,55 \checkmark$$

(5)

## Targeted Worksheet 3 Answers

4.2 Amount of money left over

$$\begin{aligned}
 &= 36\,000 \left(1 + \frac{0,09}{12}\right)^{24} \checkmark \left(1 + \frac{0,088}{4}\right)^{28} \checkmark 10\,000 \checkmark \left(1 + \frac{0,088}{4}\right)^{28} \checkmark + 2\,500 \checkmark \left(1 + \frac{0,088}{4}\right)^{16} \checkmark \\
 &= R64\,364,66 \checkmark \qquad (7)
 \end{aligned}$$

4.3 Using  $A = P(1 + i)^n \checkmark$  to calculate the effective interest rate.

$$\begin{aligned}
 R390\,000 &= R240\,000(1 + i)^5 \checkmark \\
 \sqrt[5]{\frac{390\,000}{240\,000}} - 1 &= i \checkmark \\
 i &= 10,19\% \checkmark \qquad (3)
 \end{aligned}$$

4.4 Using:  $1 + i_{eff} = \left(1 + \frac{i_{nom}}{m}\right)^m \checkmark$

$$\begin{aligned}
 1 + 10,19\% &= \left(1 + \frac{i_{nom}}{12}\right)^{12} \checkmark \\
 12\left(\sqrt[12]{1 + 10,19\%} - 1\right) &= i_{nom} \\
 i_{nom} &= 9,74\% \checkmark \qquad (3)
 \end{aligned}$$

4.5 Using:  $1 + i_{eff} = \left(1 + \frac{i_{nom}}{m}\right)^m$

$$\begin{aligned}
 1 + 10,19\% &= \left(1 + \frac{i_{nom}}{365}\right)^{365} \checkmark \\
 365\left(\sqrt[365]{1 + 10,19\%} - 1\right) &= i_{nom} \checkmark \\
 i_{nom} &= 9,70\% \checkmark \qquad (3)
 \end{aligned}$$

**[20]**

**Total: [50]**

# Exemplar Assessments

## Exemplar Assessments

Time: 1,5 hours

Name:

Surname:

### Term 2: Control Test

#### Instructions

Read the following instructions carefully before answering the questions.

1. This question paper consists of 7 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining the answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round off answers to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. Write neatly and legibly.

#### Question 1

- 1.1 Given the following quadratic sequence:  $-2; 0; 3; 7; \dots$
- 1.1.1 Write down the value of the next term in the sequence. (1)
  - 1.1.2 Determine an expression for the  $n$ th term of this sequence. (4)
  - 1.1.3 Which term in the sequence is equal to 322? (4)
- 1.2 Calculate the value of  $x$  in the following quadratic pattern:  $15; 10; 7; x; 7; \dots$  (3)

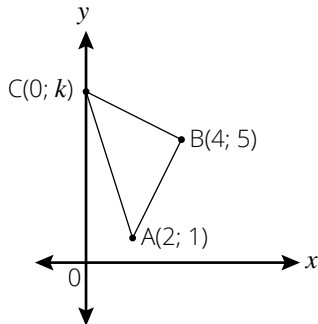
**[12]**



Exemplar Assessments

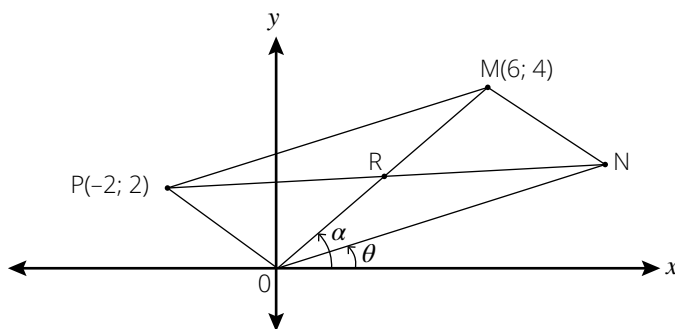
Question 2

2.1 Triangle ABC is shown in the figure below.



- 2.1.1 If  $BC = AB$ , determine the value(s) of  $k$ . (5)
- 2.1.2 Calculate the gradient of  $BC$  if  $k = 7$ . (2)
- 2.1.3 Prove that  $\triangle ABC$  is a right-angled triangle if  $k = 7$ . (3)
- 2.1.4 Determine the area of  $\triangle ABC$ . (2)

2.2 MNOP is a quadrilateral. The angle of inclination of  $OM$  is  $\alpha$  and the angle of inclination of  $ON$  is  $\theta$ .



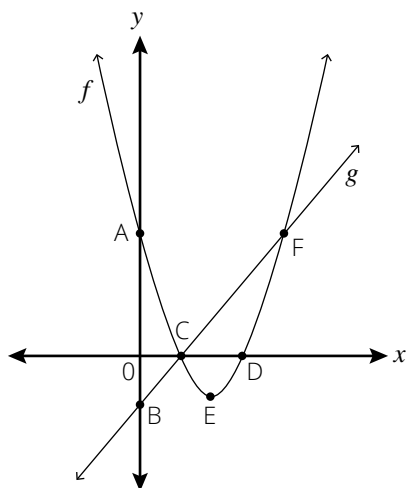
- 2.2.1 Determine the coordinates of  $R$ , the midpoint of  $OM$ . (2)
- 2.2.2 If  $OM$  and  $PN$  bisect each other, find the coordinates of  $N$ . (2)
- 2.2.3 Determine the equation of the line  $ON$ . (2)
- 2.2.4 Calculate the size of  $\widehat{MON}$ . (4)
- 2.2.5 Show that  $PM = ON$ . (4)
- 2.2.6 If  $OMNQ$  is a parallelogram, determine the coordinates of  $Q$ . (2)

[28]

### Exemplar Assessments

#### Question 3

3.1 The sketch below illustrates the graphs of  $f(x) = x^2 - 4x + 3$  and  $g(x) = x - 1$ .

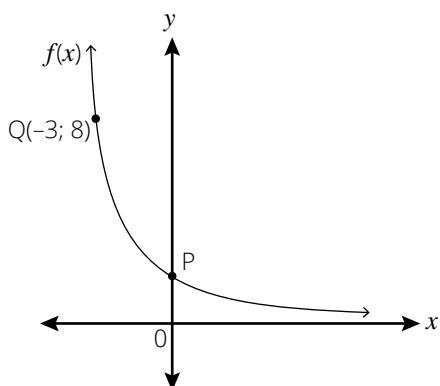


- 3.1.1 Determine the coordinates of A and B. (2)
- 3.1.2 Find the length of AB. (1)
- 3.1.3 Find the coordinates of C and D. (4)
- 3.1.4 Solve the equation  $x^2 - 5x = -4$ . (Note: This is the solution for  $f(x) = g(x)$ ) (3)
- 3.1.5 Find the coordinates of the turning point E. (3)
- 3.1.6 For what values of  $x$  is  $x^2 - 4x + 3 > x - 1$ ? (2)
- 3.1.7 For what values of  $x$  is  $f(x) < 0$ ? (2)

**[17]**

#### Question 4

4.1 The graph of  $f(x) = a^x$  is drawn below with point  $Q(-3; 8)$ .



- 4.1.1 Determine the value of  $a$ . (2)
- 4.1.2 Write down the coordinates of P. (1)
- 4.1.3 If  $g(x)$  is the reflection of  $f(x)$  in the  $x$ -axis, determine the equation of  $g(x)$  (1)
- 4.1.4 What would the equation of  $f(x)$  become if the  $x$ -axis is moved down 2 units? (1)

**[5]**

Exemplar Assessments

Question 5

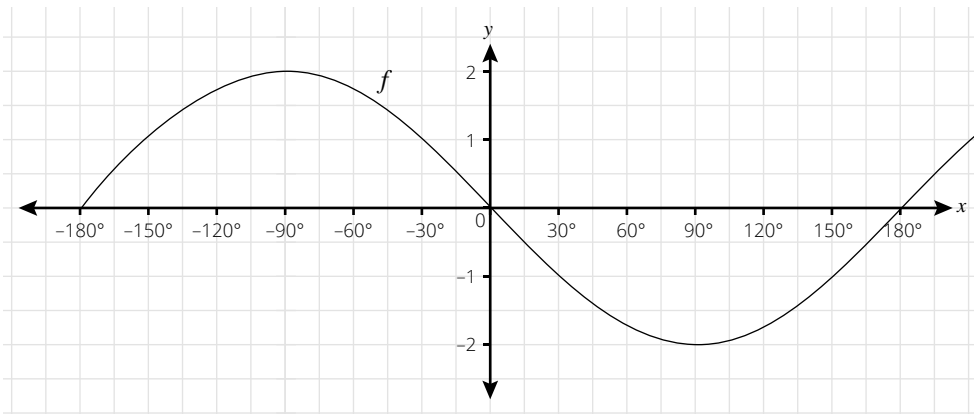
5.1 Given the function:  $f(x) = \frac{3}{x+2} - 1$ . Sketch the graph of  $f$ , showing the coordinates of the intercepts.

(3)

[3]

Question 6

6.1 The graph of  $f(x) = a \cdot \sin x$  is drawn in the sketch below for  $x \in [-180^\circ; 180^\circ]$ .



6.1.1 Determine the value of  $a$ .

(1)

6.1.2 Write down the amplitude of  $f$ .

(1)

6.1.3 Write down the period of  $g$  if  $g(x) = \frac{f(x)}{2}$ .

(1)

[3]

Question 7

7.1 Determine the general solution of  $x$ , if  $9 \sin x = 5 \cos^2 x + 3 \sin^2 x$ .

(8)

[8]

Total: [75]

## Exemplar Assessments

Time: 1 hour

Name: \_\_\_\_\_

Surname: \_\_\_\_\_

### Term 3: Control Test 1

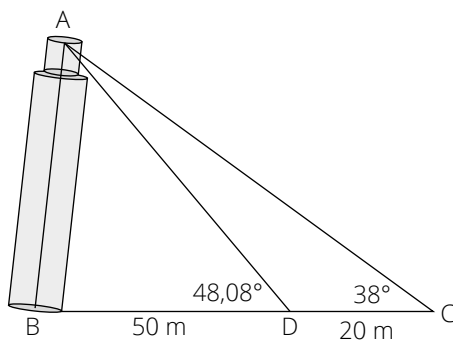
#### Instructions

Read the following instructions carefully before answering the questions.

1. This question paper consists of 3 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining the answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round off answers to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. Write neatly and legibly.

#### Question 1

- 1.1 In the diagram below, the leaning tower of Pisa AB is shown. A tourist determines that the angle of elevation of the top of the building increases from  $38^\circ$  to  $48,08^\circ$  after walking 20 metres towards the tower from point C to point D. He also determines that point D is 50 metres from the foot of the tower. BDC is horizontal and AB is not vertical.

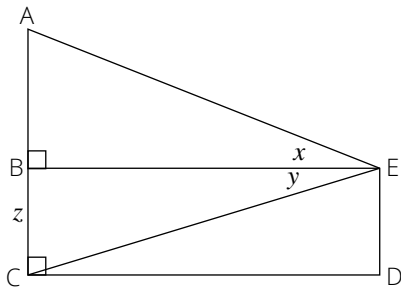


- 1.1.1 Explain why  $\angle DAC = 10,08^\circ$ . (2)
- 1.1.2 Determine the straight-line distance AD. Give your answer correct to two decimal digits. (3)
- 1.1.3 Determine the length of the tower AB correct to two decimal digits. (4)

Exemplar Assessments

1.2 In the figure below,  $BC = z$ ,  $\hat{AEB} = x$  and  $\hat{BEC} = y$ . Show that  $AC = \frac{z \sin(x + y)}{\cos x \sin y}$ .

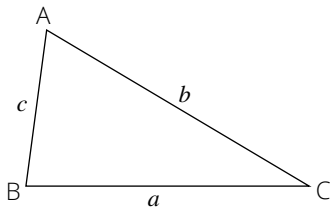
(6)



[15]

Question 2

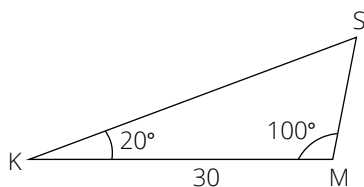
2.1 In the figure below, acute-angled  $\triangle ABC$  is drawn having C at the origin.



Prove that  $c^2 = a^2 + b^2 - 2ab \cos C$ .

(6)

2.2 The diagram below represents Mr Nu's vegetable garden.  $\angle K = 20^\circ$ ;  $\angle M = 100^\circ$  and  $KM = 30$  m.



2.2.1 Calculate the length of the fence that Mr Nu can use to fence his garden.

(5)

2.2.2 How big is Mr Nu's vegetable garden?

(3)

2.2.3 If the garden was rectangular shaped, determine the length of the garden if it has a width of 13 m.

(3)

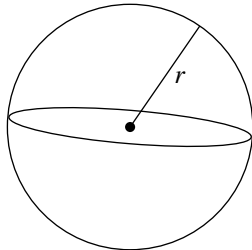
[17]

### Exemplar Assessments

#### Question 3

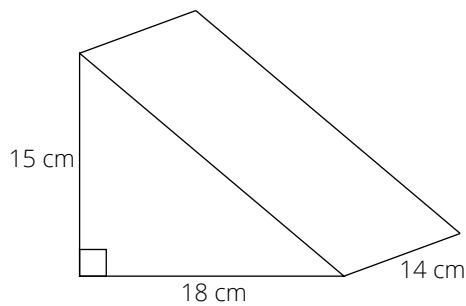
3.1.1 Calculate the volume and total surface area of a sphere given the length of the radius = 3,5 cm. Write the answer correct to 5 decimal places. (4)

(Volume of a sphere =  $\frac{4}{3}\pi r^3$  and total surface area =  $4\pi r^2$ .)



3.1.2 If the radius is doubled, calculate the volume and total surface area of the larger sphere. (2)

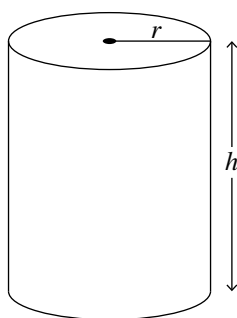
3.2 Use the figure below to answer the questions that follow.



3.2.1 Calculate the volume of the triangular prism. (2)

3.2.2 Calculate the total surface area of the prism. (4)

3.3 A cylindrical water tank has a volume of  $260 \text{ cm}^3$  with a height of  $h$  cm and a radius of  $r$  cm.



Express  $h$  in terms of  $r$  and hence determine the value of  $h$  if  $r = 3,5$  cm. (6)

[18]

**Total: [50]**

Exemplar Assessments

Time: 1 hour

Name:

Surname:

Term 3: Control Test 2

**Instructions**

**Read the following instructions carefully before answering the questions.**

1. This question paper consists of 4 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining the answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round off answers to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. Write neatly and legibly.

**Question 1**

1.1 A mathematics test results of 100 Grade 11 learners at a school are summarised in the table below:

% obtained	Number of learners
$0 \leq x < 20$	2
$20 \leq x < 30$	5
$30 \leq x < 40$	18
$40 \leq x < 50$	22
$50 \leq x < 60$	18
$60 \leq x < 70$	13
$70 \leq x < 80$	12
$80 \leq x < 100$	10

- 1.1.1 Calculate the approximate mean mark for the test. (3)
- 1.1.2 Identify the interval in which the median lies. (1)
- 1.1.3 Which is the modal interval? (1)

## Exemplar Assessments

1.2 A traffic department set up a camera to record the speed of cars travelling into the town. The findings are shown in the table below:

Speed km/h	Number of cars (frequency)	Cumulative frequency
$60 \leq x < 70$	43	
$70 \leq x < 80$	69	
$80 \leq x < 90$	110	
$90 \leq x < 100$	49	
$100 \leq x < 110$	20	
$110 \leq x < 120$	9	

- 1.2.1. Copy and complete this table. (3)
- 1.2.2 Draw a cumulative frequency graph illustrating this data. (4)
- 1.2.3 Indicate on the graph where the median can be read. (2)
- 1.2.4 Calculate the inter-quartile range for this set of data. (3)

**[17]**

## Question 2

Consider the dataset below.

147; 164; 172; 162; 157; 164; 172; 162; 166; 159; 182; 171; 163; 145; 188; 163; 164

- 2.1 Arrange the data into a stem and leaf diagram. (3)
- 2.2 Use the diagram to determine the:
  - 2.2.1 mean. (2)
  - 2.2.2 median. (2)
  - 2.2.3 mode. (2)

**[6]**



**Exemplar Assessments**

**Question 3**

In a survey, a group of 283 workers were asked which mode of transport they use to get to work. The results of the survey are summarised below.

- $x$  workers take a train, a bus and a taxi to get to work.
- 110 workers take a train and a taxi.
- 38 workers take a taxi and a bus.
- 32 workers take a train and a bus but not a taxi.
- 60 get to work by taxi only.
- 110 workers take a bus.
- 172 workers take a train.

- 3.1 Draw a Venn diagram to represent the information above. (3)
- 3.2 Determine the number of workers who take a train, a bus and a taxi to work (i.e.,  $x$ ). (6)
- 3.3 What is the probability that a worker picked from the sample takes a train and a bus to work? Give your answer as a fraction. (2)
- 3.4 What is the probability that a worker picked from the sample takes a bus but not a train? Give your answer as a fraction. (2)
- [13]**

**Question 4**

- 4.1 Given two events,  $A$  and  $B$ :  $P(B') = 0,29$ ;  $P(B) = 3P(A)$  and  $P(A \text{ or } B) = 0,88$ . Are events  $A$  and  $B$  mutually exclusive? Justify your answer with appropriate calculations. (4)
- 4.2 A bag contains 8 white balls, 6 black balls and 7 green balls. A ball is drawn at random and not replaced. A second ball is drawn.
- 4.2.1 Draw a tree diagram to represent all the probabilities. (4)
- 4.2.2 Determine the probability that both balls are green. (2)
- 4.2.3 Determine the probability that the two balls are white and green in any order. (4)
- [14]**

**Total: [50]**

## Exemplar Assessments

Time: 1 hour

Name:

Surname:

### Term 4: Control Test

#### Instructions

Read the following instructions carefully before answering the questions.

1. This question paper consists of 4 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining the answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round off answers to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. Write neatly and legibly.

#### Question 1

- 1.1 Given events  $A$  and  $B$ :  $P(A) = 0,7$ ;  $P(B) = 0,3$  and  $P(A \text{ and } B) = 0,2$ .
- 1.1.1 Are events  $A$  and  $B$  mutually exclusive? Explain your answer. (2)
- 1.1.2 Are events  $A$  and  $B$  independent? Explain your answer. (2)
- 1.2 Rudi sometimes gets a lift to and from school. When he does not get a lift, he walks. The probability that he gets a lift to school is 0,4. The probability that he walks home from school is 0,7. Getting to school and getting home from school are independent events.
- 1.2.1 Draw a tree diagram to represent the information. Write all the probabilities on the branches. (4)
- 1.2.2 Calculate the probability that Rudi walks at least one way. (3)

**[11]**

Exemplar Assessments

Question 2

The table below shows data for learners' favourite sport at a high school.

	Boys	Girls	Total
Soccer	407	43	450
No favourite sport	72	109	181
Netball	29	384	413
Athletics	A	220	C
Rugby	316	9	325
Other	63	150	213
Total	1 053	B	1 968

- 2.1 Calculate the values of A, B and C. (5)
- 2.2 One of these learners is randomly selected. What is the probability that this learner prefers netball and is a girl? (3)
- 2.3 Show with calculations whether the events of preferring netball and being a girl are independent or NOT. (4)

[12]

Question 3

- 3.1 William opened a savings account with R10 000. Two years later he deposited a further R4 000 and 5 years after the account was opened, he deposited another R3 000. If the interest was calculated at 8,6% annually, calculate how much money he had in his savings account at the end of 8 years. (4)
- 3.2 Sente wants to buy a new laptop that costs R9 000. He pays a 15% deposit and uses a hire purchase loan for the balance. Calculate his monthly payments if the loan is for 2 years at an annual interest rate of 14%. (4)
- 3.3 A business buys machinery for R2,2 million. Depreciation is calculated at 17,5% p.a., calculated on a reducing balance.
  - 3.3.1 Calculate the book value of the machinery after 4 years. (2)
  - 3.3.2 Calculate what it will cost to replace the machinery after 4 years at an expected inflation rate of 6,5% p.a. Write the answer to the nearest rand. (2)

[12]

## Exemplar Assessments

### Question 4

- 4.1 R8 000 is invested for 5 years at an interest rate of 17 % p.a., compounded monthly.
- 4.1.1 Determine the value of the investment at the end of the 5 years using the nominal interest rate given. (3)
- 4.1.2 Convert the nominal interest rate to an effective interest rate. (2)
- 4.1.3 Use the effective interest rate to calculate the value of the investment. Comment on your solution and that in 4.1.1. (2)
- 4.2 Zakhele inherits R10 000 and invests it in an account for 8 years. If the interest rate for the first 4 years is 8,4% p.a., compounded half-yearly, and then rises to 9,2% p.a., compounded monthly for the remainder of the investment, calculate how much interest he has accrued on his inheritance. (4)
- 4.3 Sipho invested R15 000 in a banking account. After 5 years he withdraws R28 000. Calculate the interest rate (rounded to two decimal places) per annum if it was compounded half-yearly. (4)

**[15]****Total: [50]**

Exemplar Assessments

Time: 3 hours

Name:

Surname:

Term 4: Final Examination Paper 1

**Instructions**

**Read the following instructions carefully before answering the questions.**

1. This question paper consists of 10 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining the answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round off answers to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. Write neatly and legibly.

**Question 1**

- 1.1 Solve for  $x$ .
- 1.1.1  $x(2x + 1) = 0$  (2)
  - 1.1.2  $3x^2 - 2x = 4$  (Correct to TWO decimal places.) (4)
  - 1.1.3  $\sqrt{x-1} + 1 = x$  (5)
  - 1.1.4  $x^2 - 3x \geq 10$  (4)
  - 1.1.5  $3^{x+3} - 3^{x+2} = 48$  (4)
  - 1.1.6  $2^{x+1} - 9 \cdot 2^x + 4 = 0$  (5)
- 1.2 Solve for  $x$  and  $y$  simultaneously:
- $$2x = y + 7 \text{ and } x^2 + xy + y^2 = 2$$
- (6)
- 1.3 The solutions to the quadratic equation are given by  $x = \frac{-2 \pm \sqrt{2p+5}}{7}$ .
- For which values of  $p$  will this equation have:
- 1.3.1 two equal solutions? (2)
  - 1.3.2 no real roots? (1)

**[33]**

## Exemplar Assessments

### Question 2

2.1 Simplify the following, without using a calculator:

2.1.1  $\left(\frac{27x^7}{x}\right)^{\frac{2}{3}}$  (3)

2.1.2  $\frac{\sqrt{48} - \sqrt{32}}{\sqrt{12} - \sqrt{8}}$  (5)

2.2 Without the use of a calculator, find the value of:

$\sqrt{10\,002^2 - 10\,000 \times 10\,004}$  (4)

**[12]**

### Question 3

3.1 Given the linear pattern: 42; 53; 64; ...; 70

3.1.1 Determine the formula for the  $n$ th term of the pattern. (2)

3.1.2 Calculate the value of  $T_{10}$ . (2)

3.1.3 Determine the number of terms in the pattern. (2)

3.2 Given the sequence:  $\frac{4}{3}, \frac{7}{6}, \frac{10}{9}, \frac{13}{12}, \dots$

3.2.1 Write down the next two terms. (2)

3.2.2 Write down an expression for the  $n$ th term of the sequence. (2)

**[10]**

### Question 4

4.1 Given the linear pattern: 17; 13; 9; ...

4.1.1 Write down the fourth term. (1)

4.1.2 Determine a formula for the general term of the pattern. (2)

4.1.3 Which term of the pattern will have a value of  $-83$ ? (2)

4.1.4 If this linear pattern forms the first difference of a quadratic pattern  $Q_n$ , determine the first difference between  $Q_{470}$  and  $Q_{469}$ . (3)

4.2 A quadratic pattern has a constant second difference of 2 and  $T_5 = T_{17} = 29$ .

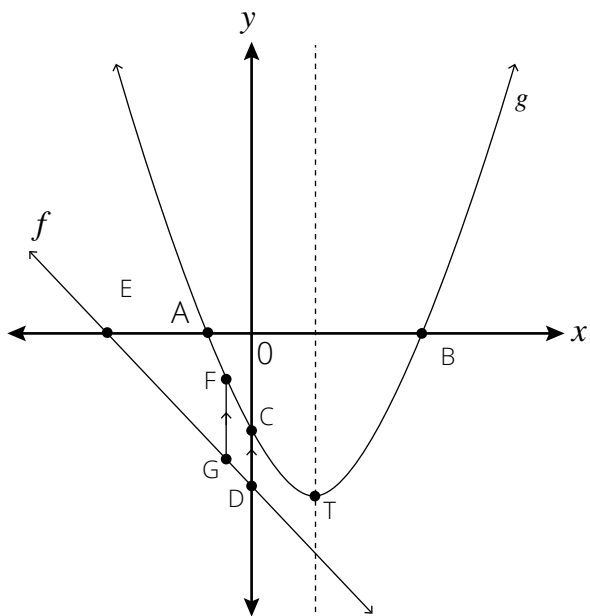
Determine an expression for the  $n$ th term in the form  $T_n = an^2 + bn + c$ . (5)

**[16]**

Exemplar Assessments

Question 5

The straight line graph  $f(x) = -x - 5$  and the parabola  $g(x) = a(x - 3)(x + 1)$  are shown in the sketch below. Points A, B and C are the intercepts of  $g$  with the axes. D and E are the intercepts of  $f$  with the axes. FG is parallel to the  $y$ -axis and T is the turning point of the parabola



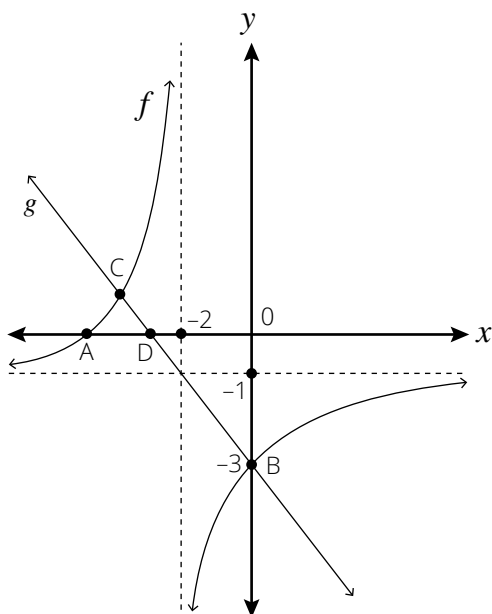
- 5.1 If the coordinates of the turning point T are  $(1; -4)$ , calculate the value of  $a$  in the equation  $g(x) = a(x - 3)(x + 1)$ . (2)
- 5.2 Determine the nature of the roots of  $-x - 5 = x^2 - 2x - 3$ . (3)
- 5.3 If the  $x$ -coordinate of the point G is  $-\frac{1}{2}$ , calculate the length of FG. (5)
- 5.4 Calculate the length of EB. (3)
- 5.5 For which value(s) of  $x$  is  $g(x)$  decreasing? (1)
- 5.6 Write down the domain and range of  $g(x)$ . (3)
- 5.7 Write down the equation of  $h(x)$ , the reflection of  $f(x)$  in the  $x$ -axis. (2)

[19]

## Exemplar Assessments

### Question 6

The sketch below shows the graphs  $f(x) = \frac{k}{x+p} + q$  and  $g(x) = mx + c$ .  $B(0; -3)$  is the  $y$ -intercept of  $f$  and  $g$ .



- 6.1 Determine the values of  $k$ ,  $p$  and  $q$ . (5)
- 6.2 Write down the equations of the asymptotes of the hyperbola. (2)
- 6.3 Calculate the values of  $m$  and  $c$  in the equation  $g(x) = mx + c$ . (2)
- 6.4 Write down the equation for the other axis of symmetry of  $f(x)$ . (2)
- 6.5 Calculate the length of  $CB$  and leave your answer in surd form. (4)

**[13]**

### Question 7

Given  $g(x) = 3^x$  and  $f(x) = -3^{x+1} + 1$ .

- 7.1 Sketch the following graphs of  $g$  and  $f$  on the same set of axes. Show all intercepts and asymptotes. (5)
- 7.2 From the sketch in 1, what is the range of:
  - 7.2.1  $g(x)$ ? (2)
  - 7.2.2  $-f(x)$ ? (3)
- 7.3 Give the equation of  $h(x)$ , the reflection of  $g(x)$  in the  $y$ -axis. (2)

**[12]**



Exemplar Assessments

Question 8

- 8.1 A car is worth R140 000 now. If it depreciates at a rate of 14% p.a. on a straight line depreciation, calculate the value of the car after 4 years. (3)
- 8.2 Zakhele inherits R10 000 and invests it in an account for 8 years. If the interest rate for the first years is 8,4% p.a., compounded half-yearly, and then rises to 9,2% p.a., compounded monthly for the remainder of the investment, calculate how much interest he has accrued on his inheritance. (4)
- 8.3 Samuel invests R14 500 at 8,5% p.a., compounded monthly for 3 years.
  - 8.3.1 Calculate the effective interest rate correct to two decimal places. (3)
  - 8.3.2 If he withdraws R5 000 after 3 years and the interest rate drops to 7,8% p.a., compounded quarterly, calculate the total amount of the investment after 2 more years. (5)

**[15]**

Question 9

A survey was conducted amongst 75 learners at a school to establish their involvement in three sport activities, namely Soccer, Netball and Volleyball. The results were as follows:

- 35 learners play Soccer (S).
- 42 learners play Netball (N).
- 28 learners play Volleyball (V).
- 15 learners play soccer and netball.
- 14 learners play netball and volleyball.
- 13 learners play volleyball and soccer.
- 7 learners were not involved in any of the sport.

- 9.1 Display this information in a Venn diagram. Calculate how many learners were involved in all the sports. (6)
- 9.2 Determine how many learners were only involved in soccer. (2)
- 9.3 A learner is randomly chosen from those surveyed. Find the probability that:
  - 9.3.1 The learner is involved in netball only. (2)
  - 9.3.2 The learner is involved in netball given that the learner is involved in soccer. (2)
  - 9.3.3 The learners that were not involved in volleyball. (2)

**[14]**

Question 10

- 10.1 Given two events,  $A$  and  $B$ :  $P(A) = \frac{2}{3}$ ;  $P(B) = \frac{3}{5}$  and  $P(A \cap B) = \frac{4}{5}$ . Determine  $P(A \text{ and } B)$ . (2)
- 10.2 A bag contains 6 blue, 5 red and 9 white marbles. A marble is drawn and replaced, and another marble is then drawn. Draw a tree diagram to represent this information and use it to determine the probability that both marbles are white. (4)

**[6]**

**Total: [150]**

## Exemplar Assessments

Time: 3 hours

Name:

Surname:

### Term 4: Final Examination Paper 2

#### Instructions

Read the following instructions carefully before answering the questions.

1. This question paper consists of 9 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining the answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round off answers to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. Write neatly and legibly.

#### Question 1

The table below shows the number of cans of food collected by 9 classes during a charity drive.

5	8	15	20	25	27	31	36	75
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- 1.1 Calculate the range of the data. (1)
- 1.2 Calculate the standard deviation of the data. (2)
- 1.3 Determine the median of the data. (1)
- 1.4 Determine the interquartile range of the data. (3)
- 1.5 Draw a box-and-whisker diagram for the data above. (3)
- 1.6 Describe the skewness of the data. (1)
- 1.7 Identify outliers, if any exist, for the above data. (1)

**[12]**

Exemplar Assessments

Question 2

The individual masses in kg of 30 rugby players are given below:

86; 92; 76; 88; 93; 87; 89; 79; 101; 93; 91; 82; 85; 84; 96; 100; 78; 80; 84; 90; 97; 82; 85; 72; 79; 90; 101; 77; 65; 93

Mass (kg)	Frequency	Cumulative Frequency
$60 \leq x < 70$		
$70 \leq x < 80$		
$80 \leq x < 90$		
$90 \leq x < 100$		
$100 \leq x < 110$		

- 2.1 Complete the table. (2)
- 2.2 Draw an ogive (cumulative frequency curve) to represent the information in the table. (3)
- 2.3 Calculate the mean mass of the rugby players. (2)
- 2.4 Determine how many rugby players have masses within one standard deviation of the mean. (2)

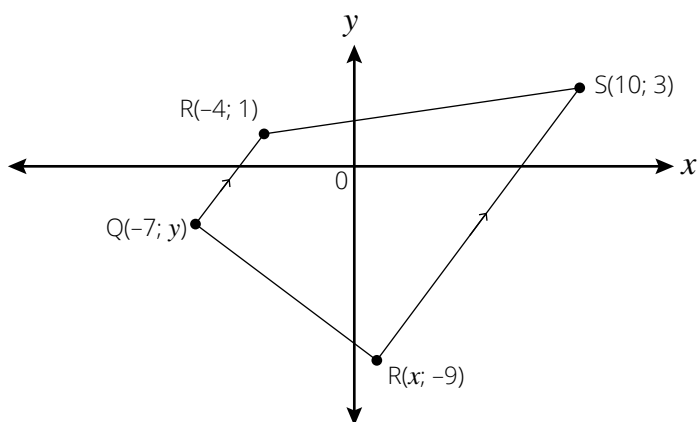
**[9]**

Question 3

- 3.1 The points  $D(-1; 2)$ ,  $E(4; -2)$  and  $F(-5; -3)$  are three vertices of triangle DEF. Determine:
  - 3.1.1 the gradients of DF and DE. (4)
  - 3.1.2 whether DF and DE are perpendicular to each other. (2)
  - 3.1.3 the equation of the line DE. (3)
  - 3.1.4 the  $y$ -coordinate of point G on DE with  $x$ -coordinate 6. (2)
  - 3.1.5 the lengths of DF and DE. (4)
  - 3.1.6 the area of triangle DEF. (2)

### Exemplar Assessments

3.2 Trapezium PQRS is shown in the figure below.



Determine:

- 3.2.1 the value of  $x$  if the length RS is 15 units. (5)
- 3.2.2 the coordinates of T, the midpoint of RS. (2)
- 3.2.3 the gradient of PT. (2)
- 3.2.4 the value of  $y$  if  $QR \perp RS$ . (4)
- 3.2.5 whether  $QR \parallel PT$  or not. (2)

**[32]**

### Question 4

4.1 Simplify:

4.1.1  $\frac{\sin 100^\circ \cdot \tan^2 225^\circ}{\tan 30^\circ \cdot \cos 370^\circ \cdot \sin 120^\circ}$  (6)

4.1.2  $\frac{\sin(90^\circ + x) \cos^2(90^\circ - x)}{\cos(180^\circ - x) \sin(x - 180^\circ) \tan(180^\circ + x) \cos(-x + 360^\circ)}$  (7)

4.2 If  $\sin 32^\circ = k$ , determine the following in terms of  $k$ :

4.2.1  $\cos 58^\circ$  (1)

4.2.2  $\sin 212^\circ$  (2)

4.2.3  $\tan 32^\circ$  (3)

4.3 Prove:  $\frac{1 - \sin \theta}{1 + \sin \theta} = \left( \frac{1}{\cos \theta} - \frac{\sin \theta}{\cos \theta} \right)^2$  (4)

4.4 Given the identity:  $\frac{\cos x}{1 + \sin x} + \tan x = \frac{1}{\cos x}$   
 Prove the identity. (5)

For which values of  $x$  is the identity undefined? (3)

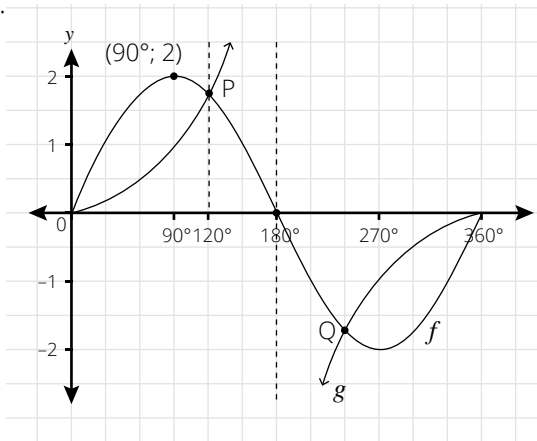
4.5 Solve:  $\sin(x + 10^\circ) - \cos(x - 30^\circ) = 0$  for  $x \in [-180^\circ; 180^\circ]$ . (7)

**[38]**

Exemplar Assessments

Question 5

The graph  $f(x) = a \cdot \sin x$  and  $g(x) = \tan bx$  are shown in the sketch below for  $x \in [0^\circ; 360^\circ]$

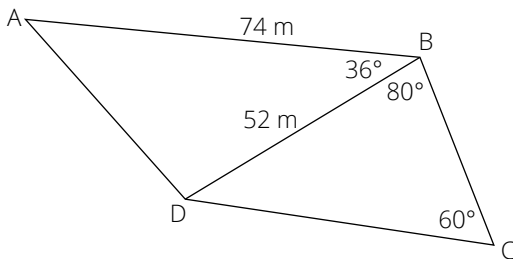


- 5.1 Determine the values of  $a$  and  $b$ . (2)
- 5.2 Write down the coordinates of P and Q. (2)
- 5.3 For which values of  $x$  is  $f(x) \leq g(x)$ ? (4)
- 5.4 Write down the equation of the asymptote of  $g$ . (1)

[9]

Question 6

Use the figure below to answer the questions that follow.



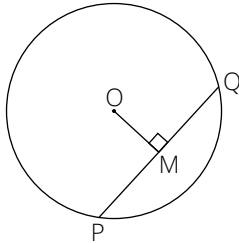
- 6.1 Determine the length of CD. (3)
- 6.2 Determine the length of AD. (3)
- 6.3 Calculate the area of ABCD. (5)

[11]

## Exemplar Assessments

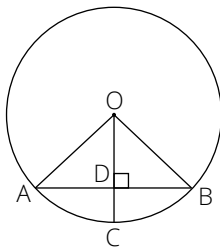
### Question 7

7.1 Use the figure below to prove the theorem that states:



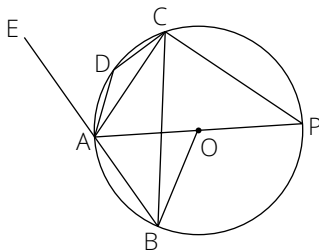
The line drawn from the centre of a circle perpendicular to a chord bisects the chord. (6)

7.2 AB is a chord in circle, centre O. OC is perpendicular to AB.



If  $AB = 10$  cm and  $OA = 13$  cm, calculate the length of DC. (6)

7.3 AP is a diameter of circle, centre O. Chord BC bisects  $\widehat{DCP}$  and  $PA \perp BC$ .



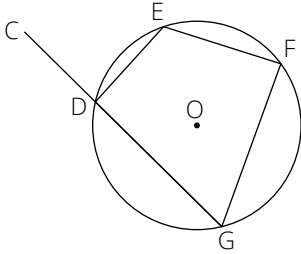
Find five angles equal to  $\widehat{BCP}$ . Give reasons for each answer. (10)

**[22]**

Exemplar Assessments

Question 8

Given circle with centre O and points D, E, F and G points on the circumference.



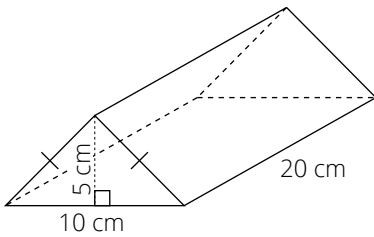
8.1 Prove that  $\angle D + \angle F = 180^\circ$ . (6)

8.2 Deduce that  $\widehat{CDE} = \angle F$ . (5)

**[11]**

Question 9

9.1 Calculate the total surface area and the volume of the triangular prism shown below. (6)



**[6]**

**Total: [150]**

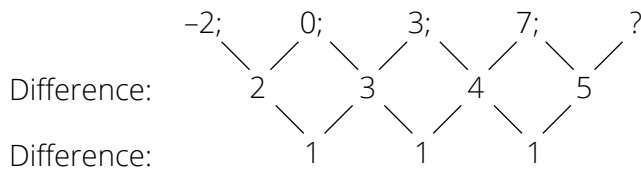
## Exemplar Assessments Memorandum

Time: 1,5 hours

### Term 2: Control Test

- This memorandum serves as a guide for the allocation of marks.
- Any acceptable / valid method can be used.
- Do not forget to mark with CA in mind. (Corrective Accuracy)

1.1.1



Difference:

Difference:

Next term is: 12 ✓

(1)

1.1.2

$$2a = 1$$

$$a = \frac{1}{2} \checkmark$$

$$3a + b = 2$$

$$3\frac{1}{2} + b = 2$$

$$b = \frac{1}{2} \checkmark$$

$$a + b + c = -2$$

$$\frac{1}{2} + \frac{1}{2} + c = -2$$

$$c = -3 \checkmark$$

(3)

1.1.3

$$T_n = \frac{1}{2}n^2 + \frac{1}{2}n - 3 \checkmark$$

$$322 = \frac{1}{2}n^2 + \frac{1}{2}n - 3 \checkmark$$

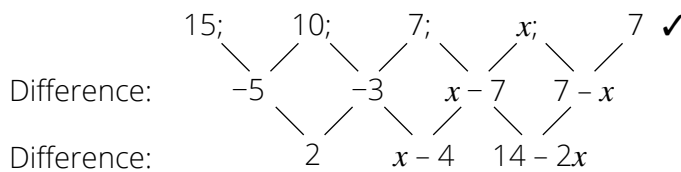
$$0 = n^2 + n - 650 \checkmark$$

$$0 = (n + 26)(n - 25) \checkmark$$

$$\therefore n = 25 \checkmark$$

(4)

1.2



Difference:

Difference:

$$\therefore 2 = x - 4 \checkmark$$

$$6 = x \checkmark$$

(3)

**[12]**



Exemplar Assessments Memorandum

- 2.1.1  $AB = \sqrt{(4 - 2)^2 + (5 - 1)^2} = \sqrt{20}$   
 $BC = \sqrt{(4)^2 + (5 - k)^2} = \sqrt{20} \checkmark$   
 $16 + 25 - 10k + k^2 = 20 \checkmark$   
 $k^2 - 10k + 21 = 0 \checkmark$   
 $(k - 7)(k - 3) = 0$   
 $k = 7 \checkmark$  ... By inspection  $k \neq 3$  (4)
- 2.1.2  $m_{BC} = \frac{7 - 5}{0 - 4} \checkmark = -\frac{1}{2} \checkmark$  (2)
- 2.1.3  $m_{AB} = \frac{5 - 1}{4 - 2} = 2 \checkmark$   
 $m_{BC} \times m_{AB} = -1 \checkmark$   
 $BC \perp AB \checkmark$   
 $\triangle ABC$  is a right-angled triangle. (3)
- 2.1.4 Area of  $\triangle ABC = \frac{1}{2}(AB)(BC) = \frac{1}{2}(\sqrt{20})(\sqrt{20}) = 10$  square units  $\checkmark$  (2)
- 2.2.1  $R(3; 2) \checkmark \checkmark$  (2)
- 2.2.2  $N(8; 2) \checkmark \checkmark$  (2)
- 2.2.3 ON:  $y = \frac{1}{4}x \checkmark \checkmark$  (2)
- 2.2.4  $\tan \theta = \frac{1}{4}$   
 $\theta = 14,04^\circ \checkmark$   
 $m_{OM} = \frac{2}{3}$   
 $\tan \alpha = \frac{2}{3} \checkmark$   
 $\alpha = 33,69^\circ \checkmark$   
 $\widehat{MON} = 19,65^\circ \checkmark$  (4)
- 2.2.5  $PM = \sqrt{(-2 - 6)^2 + (2 - 4)^2} = \sqrt{68} \checkmark$   
 $ON = \sqrt{(8)^2 + (2)^2} \checkmark = \sqrt{68} \checkmark$   
 $\therefore PM = ON \checkmark$  (4)
- 2.2.6  $Q(2; -2) \checkmark \checkmark$  By inspection (2)
- [27]**
- 3.1.1 A is when  $x = 0$  for  $f$ . B is when  $x = 0$  for  $g$ .  
 $A(0; 3) \checkmark$  and  $B(0; -1) \checkmark$  (2)
- 3.1.2  $AB = 4$  units  $\checkmark$  (1)
- 3.1.3 C and D are  $x$ -intercepts of  $f$   
 At C and D,  $0 = x^2 - 4x + 3 \checkmark$   
 $(x - 3)(x - 1) = 0, x = 1$  or  $x = 3 \checkmark$   
 $\therefore C(1; 0) \checkmark$  and  $D(3; 0) \checkmark$  (4)

### Exemplar Assessments Memorandum

3.1.4  $x^2 - 5x + 4 = 0$  ✓  
 $(x - 4)(x - 1) = 0$  ✓  
 $x = 1$  or  $x = 4$  ✓ (3)

3.1.5 At E:  $x = -\frac{b}{2a} = 2$  ✓ and  $y = 2^2 - 4(2) + 3 = -1$  ✓  
 $E(2; -1)$  ✓ (3)

3.1.6  $x^2 - 4x + 3 > x - 1$   
 $x^2 - 4x - x + 3 + 1 > 0$  collect like terms  
 $x^2 - 5x + 4 > 0$  ✓  
 $(x - 1)(x - 4) > 0$  factorise  
 $x < 1$  or  $x > 4$  ✓ (2)

3.1.7  $f(x) < 0$  when  $1 < x < 3$  ✓ (2)

**[17]**

4.1.1  $f(-3) = 8$   
 $\therefore 8 = a^{-3}$  ✓  
 $2^3 = a^{-3}$  or  $\left(\frac{1}{2}\right)^{-3} = a^{-3}$   
 $a = \frac{1}{2}$  ✓ (2)

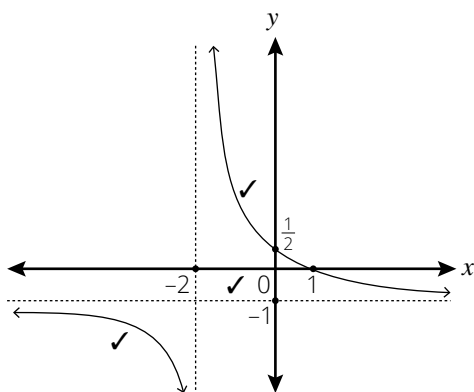
4.1.2  $P(0; 1)$  ✓ At P,  $x = 0$  (1)

4.1.3  $g(x) = -\left(\frac{1}{2}\right)^x$  ✓ (1)

4.1.4  $f(x) = \left(\frac{1}{2}\right)^x + 2$  ✓ (1)

**[5]**

5.1 (3)



**[3]**

6.1.1  $f(90) = -2$   
 $a \sin 90 = -2$   
 $a = -2$  ✓ (1)

6.1.2 Amplitude of  $f$  is 2 ✓ (1)

6.1.3 Period of  $g$  is  $360^\circ$  ✓ (1)

**[3]**

Exemplar Assessments Memorandum

7.1

$$9 \sin x = 5 \cos^2 x + 3 \sin^2 x$$

$$9 \sin x = 5(1 - \sin^2 x) + 3 \sin^2 x \checkmark \quad \text{identity}$$

$$2 \sin^2 x + 9 \sin x - 5 = 0 \checkmark \checkmark \quad \text{standard form}$$

$$(\sin x + 5)(2 \sin x - 1) = 0 \checkmark \quad \text{factorise}$$

$$\sin x \neq -5 \text{ or } \sin x = \frac{1}{2} \checkmark \checkmark \quad \text{factors}$$

$$x = 30^\circ + 360^\circ k \text{ or } x = 150^\circ + 360^\circ k, k \in \mathbb{Z} \checkmark \checkmark \quad (8)$$

[8]

**Total: [75]**

## Exemplar Assessments Memorandum

Time: 1 hour

### Term 3: Control Test 1

- This memorandum serves as a guide for the allocation of marks.
- Any acceptable / valid method can be used.
- Do not forget to mark with CA in mind. (Corrective Accuracy)

1.1.1  $48,08^\circ - 38^\circ = 10,08^\circ$  (ext.  $\angle$  of  $\Delta$ ) ✓✓ (2)

1.1.2 Using the sine rule:  $\frac{AD}{\sin 38^\circ} = \frac{20}{\sin 10,08^\circ}$  ✓

$$AD = \frac{20 \sin 38^\circ}{\sin 10,08^\circ}$$
 ✓

$AD = 70,35 \text{ m}$  ✓ (3)

1.1.3 Using the cosine rule:  $d^2 = a^2 + b^2 - 2ab \cos D$  ✓

Now,  $(AB)^2 = (70,35)^2 + (50)^2 - 2(70,35)(50)\cos 48,08^\circ$  ✓

$$AB = \sqrt{(70,35)^2 + (50)^2 - 2(70,35)(50)\cos 48,08^\circ}$$
 ✓

$AB = 52,43 \text{ m}$  ✓ (4)

1.2 In  $\Delta ACE$ :  $\frac{AC}{\sin(x+y)} = \frac{CE}{\sin(90^\circ-x)}$  ✓

$$AC = \frac{CE \cdot \sin(x+y)}{\cos x}$$
 ✓

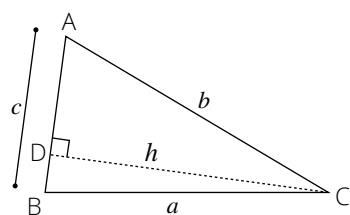
$$\sin y = \frac{z}{CE}$$
 ✓

$$CE = \frac{z}{\sin y}$$
 ✓

$$AC = \frac{z \cdot \sin(x+y)}{\cos x \cdot \sin y}$$
 ✓ (6)

[15]

2.1 Construction: Draw  $CD \perp BA$  ✓



Proof:  $a^2 = BD^2 + h^2$  Pythagoras

$$a^2 = (c - AD)^2 + h^2$$
 ✓

$$a^2 = c^2 - 2c \cdot AD + AD^2 + h^2$$

$$a^2 = c^2 - 2c \cdot AD + b^2$$
 Pythagoras ✓

$$a^2 = b^2 + c^2 - 2c \cdot AD$$
 ① ✓

In  $\Delta ADC$ :  $\frac{AD}{b} = \cos A$

$$AD = b \cos A$$
 ② ✓

② in ①:  $a^2 = b^2 + c^2 - 2bc \cos A$  ✓ (6)

## Exemplar Assessments Memorandum

2.2.1 The length of the fence is the perimeter of the garden.

$$\text{Perimeter of the garden} = KM + MS + SK \checkmark$$

We need to find MS and SK:

$$\text{Using sine rule: } \frac{MS}{\sin 20^\circ} = \frac{30}{\sin 60^\circ} \quad (\angle S = 60^\circ, \text{ int. } \angle \text{s of } \Delta)$$

$$MS = \frac{30 \sin 20^\circ}{\sin 60^\circ}$$

$$MS = 11,85 \text{ m } \checkmark$$

$$\frac{SK}{\sin 100^\circ} = \frac{30}{\sin 60^\circ} \quad (\angle S = 60^\circ, \text{ int. } \angle \text{s of } \Delta)$$

$$SK = \frac{30 \sin 100^\circ}{\sin 60^\circ}$$

$$SK = 34,11 \text{ m } \checkmark$$

$$\text{Now, the perimeter of the garden} = 30 + 11,85 + 34,11 \checkmark$$

$$\text{The perimeter of the garden} = 75,96 \text{ m } \checkmark \quad (5)$$

2.2.2 Using the area rule:  $\text{Area} = \frac{1}{2}ks \sin M \checkmark$

$$\text{Area} = \frac{1}{2}(11,85)(30) \sin 100^\circ \checkmark$$

$$\text{Mr Nu's garden is } 175,05 \text{ m}^2. \checkmark \quad (3)$$

2.2.3 Perimeter of the garden = Perimeter of a rectangle:

$$P = 2L + 2W \checkmark$$

$$75,96 \text{ m} = 2L + 2(13) \checkmark$$

$$2L = 49,96 \text{ m}$$

$$L = 24,98 \text{ m}$$

$$\text{Mr Nu's garden is } 24,98 \text{ m in length. } \checkmark \quad (3)$$

**[17]**

3.1.1 Volume of sphere =  $\frac{4}{3}\pi(3,5)^3 = 179,59438 \text{ cm}^3 \checkmark\checkmark$

$$\text{Total surface area} = 4\pi(3,5)^2 = 153,93804 \text{ cm}^2 \checkmark\checkmark \quad (4)$$

3.1.2 Volume of enlarged sphere =  $179,59438 \times 2^3 = 1\,436,76 \text{ cm}^3 \checkmark$

$$\text{Total surface area} = 153,93804 \times 2^2 = 615,75 \text{ cm}^2 \checkmark \quad (2)$$

3.2.1 Volume =  $\frac{1}{2}(15 \times 18) \times 14 \checkmark = 1\,890 \text{ cm}^3 \checkmark \quad (2)$

3.2.2 The length of the hypotenuse =  $\sqrt{15^2 + 18^2} = 23,43$

$$\text{Total surface area} = \frac{1}{2}(15 \times 18) \times 2 + (23,43 \times 14) + (18 \times 14) + (15 \times 14) \checkmark\checkmark\checkmark$$

$$\text{Total surface area} = 1\,060,02 \text{ cm}^2 \checkmark \quad (4)$$

3.3  $V = \pi r^2 h$  making  $h$  the subject

$$\frac{260}{\pi r^2} = \frac{\pi r^2 h}{\pi r^2} \checkmark$$

$$h = \frac{260}{\pi r^2} \checkmark$$

$$h = \frac{260}{3,14(3,5)r} = \frac{260}{38,47} \checkmark = 6,76 \text{ cm } \checkmark \quad (6)$$

**[18]**

**Total: [50]**

## Exemplar Assessments Memorandum

Time: 1 hour

### Term 3: Control Test 2

- This memorandum serves as a guide for the allocation of marks.
- Any acceptable / valid method can be used.
- Do not forget to mark with CA in mind. (Corrective Accuracy)

1.1.1  $x = \frac{(2 \times 10) + (5 \times 25) + (18 \times 35) + (22 \times 45) + (18 \times 55) + (13 \times 65) + (12 \times 75) + (10 \times 90)}{100}$   
 $= \frac{5400}{100} \checkmark = 54\% \checkmark$  (3)

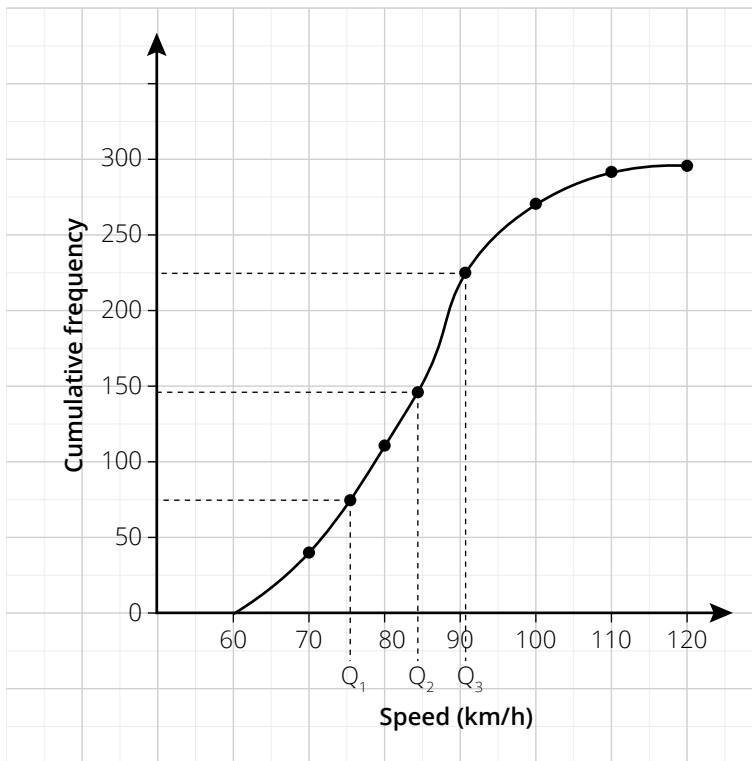
1.1.2  $50 \leq x < 60 \checkmark$  (1)

1.1.3  $40 \leq x < 50 \checkmark$  (1)

1.2.1 (3)

Speed (km/h)	Number of cars (frequency)	Cumulative frequency
$60 \leq x < 70$	43	43
$70 \leq x < 80$	69	112
$80 \leq x < 90$	110	222
$90 \leq x < 100$	49	271
$100 \leq x < 110$	20	291
$110 \leq x < 120$	9	300

1.2.2. Speed of cars ✓✓✓✓ (4)



1.2.3 The median speed is shown at 84 km/h ✓ at  $Q_2$  ✓ (2)

1.2.4  $Q_3 - Q_1 \checkmark = 91 - 76 \checkmark = 15 \text{ km/h } \checkmark$  (3)

[17]

Exemplar Assessments Memorandum

2.1

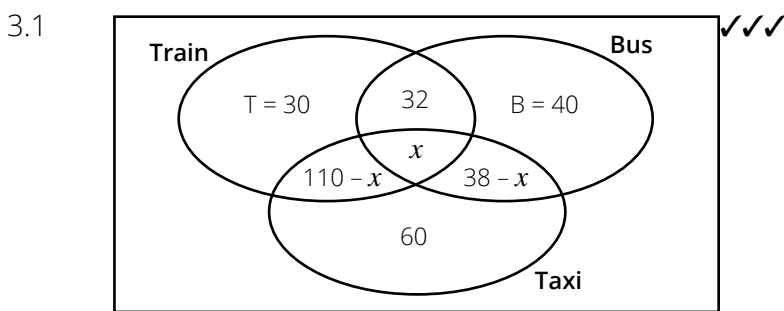
Stem	Leaf
14	5 7
15	7 9
16	2 2 3 3 4 4 4 6
17	1 2 2
18	2 8

2.2.1 mean =  $\frac{\sum fx}{n} = \frac{2\,801}{17} = 164,76$  ✓✓ (2)

2.2.2 median = 164 (data in the 9th position) ✓✓ (2)

2.2.3 mode = 164 (most common) ✓✓ (2)

[6]



(3)

3.2 Bus:  $32 + x + 38 - x + B = 110$   
 $B = 40$

Train:  $T + 32 + x + 110 - x = 172$   
 $T = 30$  ✓

Taxi:  $x + 110 - x + 60 + 38 - x + 60$  ✓

All:  $30 + 32 + x + 110 - x + 60 + 38 - x + 40 = 283$

$310 - 283 = x$

$x = 27$  ✓ (6)

3.3  $P(\text{train and a bus}) = \frac{32 + 27}{283} = \frac{59}{283}$  ✓✓ (2)

3.4  $P(\text{bus but not a train}) = \frac{40 + 38 - 27}{283} = \frac{51}{283}$  ✓✓ (2)

[13]

4.1  $P(B) = 1 - 0,29$

$P(B) = 0,71$  ✓

$P(A) = \frac{0,71}{3} = 0,24$  ✓

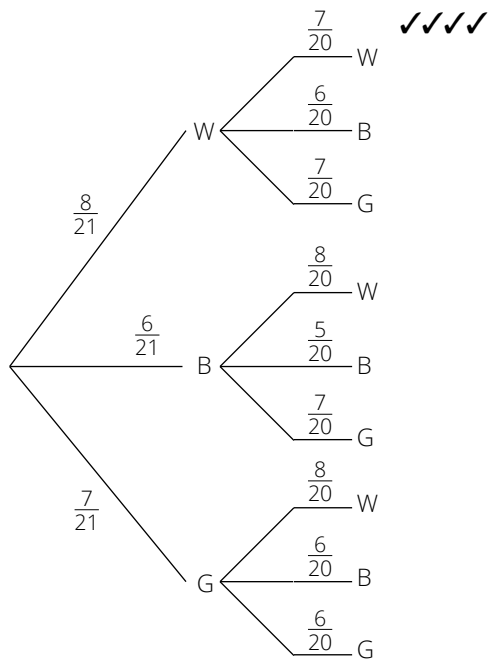
$0,88 = 0,24 + 0,71 - P(A \text{ and } B)$

$P(A \text{ and } B) = 0,07$  ✓

Events  $A$  and  $B$  are not mutually exclusive since  $P(A \text{ and } B) \neq 0$  ✓ (4)

### Exemplar Assessments Memorandum

4.2.1



(4)

4.2.2  $P(\text{both green}) = \frac{7}{21} \times \frac{6}{20} = \frac{1}{10} \checkmark\checkmark$

(2)

4.2.3  $P(\text{white and green}) = \frac{8}{21} \times \frac{7}{20} + \frac{7}{21} \times \frac{8}{20} \checkmark\checkmark = \frac{2}{15} + \frac{2}{15} = \frac{4}{15} \checkmark\checkmark$

(4)

**[14]**

**Total: [50]**



Exemplar Assessments Memorandum

Time: 1 hour

Term 4: Control Test

- This memorandum serves as a guide for the allocation of marks.
- Any acceptable / valid method can be used.
- Do not forget to mark with CA in mind. (Corrective Accuracy)

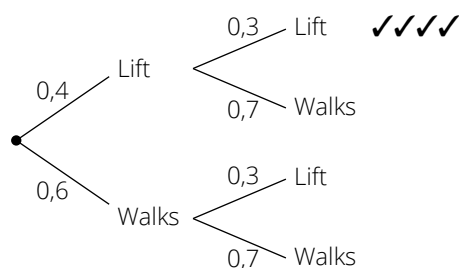
1.1.1 Events A and B are not mutually exclusive since  $P(A \text{ and } B) \neq 0$ . ✓✓ (2)

1.1.2  $P(A) \times P(B) = 0,7 \times 0,3 = 0,21$  ✓

$P(A \text{ and } B) = 0,2$

Events A and B are not independent since  $P(A) \times P(B) \neq P(A \text{ and } B)$ . (2)

1.2.1 (4)



1.2.2  $P(\text{walks at least one way}) = P(LW) \text{ or } P(WL) \text{ or } P(WW)$  ✓

$P(LW) + P(WL) + P(WW)$

$= 0,28 + 0,18 + 0,42$  ✓  $= 0,88$  ✓ (3)

[11]

2.1  $407 + 72 + 29 + A + 316 + 63 = 1\ 053$  ✓✓

$A = 166$

$1\ 053 + B = 1\ 968$

$B = 915$  ✓

$450 + 181 + 413 + C + 325 + 213 = 1\ 968$

$C = 386$  ✓✓ (5)

2.2  $P(\text{prefers netball and is a girl}) = \frac{\text{how many girls prefer netball}}{\text{number of learners}}$  ✓✓

$P(\text{prefers netball and is a girl}) = \frac{384}{1\ 968} \approx 0,1951$  ✓ (3)

2.3 They are independent if and only if:

$P(\text{prefers netball and is a girl}) = P(\text{preferring netball}) \times P(\text{girl})$  ✓✓

$\frac{384}{1\ 968} \neq \frac{413}{1\ 968} \times \frac{915}{1\ 968}$

$0,1951 \neq 0,09757$  ✓

They are NOT independent. ✓ (4)

[12]

### Exemplar Assessments Memorandum

3.1  $[10\,000(1 + 0,086)^2 + 4\,000](1 + 0,086)^3 \checkmark = 20\,229,28391$   
 $(20\,229,28391 + 3\,000)(1,086)^3 \checkmark = R29\,752,63 \checkmark$  (4)

3.2  $9\,000 \text{ less } 15\% = 7\,650 \checkmark$   
 $7\,650(1 + 0,14 \times 2) \checkmark = R9\,792 \checkmark$   
 $9\,792 \div 24 = R408 \text{ monthly } \checkmark$  (4)

3.3  $2\,200\,000(1 - 0,175)^4 \checkmark = R1\,019\,150,86 \checkmark$  (2)

3.4  $2\,200\,000(1 + 0,065)^4 \checkmark = R2\,830\,226 \checkmark$  (2)

**[12]**

4.1.1  $A = P \left(1 + \frac{i}{m}\right)^{nm}$   
 $A = 8\,000 \left(1 + \frac{0,17}{12}\right)^{60} \checkmark \checkmark = R18\,605,87 \checkmark$  (3)

4.1.2  $1 + i_{\text{eff}} = \left(\frac{1 + i_{\text{nom}}}{m}\right)^m$   
 $i_{\text{eff}} = \left(\frac{1 + i_{\text{nom}}}{m}\right)^m - 1 \checkmark$   
 $i_{\text{eff}} = 18,38917282\% = 18,39\% \checkmark$  (2)

4.1.3  $A = P(1 + i)^n$   
 $A = 8\,000(1 + 0,1838917282)^5 \checkmark = R18\,605,88$   
 The solutions are similar. (2)

4.2  $A = 10\,000 \checkmark \left(1 + \frac{0,084}{2}\right)^8 \left(1 + \frac{0,092}{12}\right)^{48} \checkmark = R20\,051,76 \checkmark$   
 The interest earned is R10 051,76  $\checkmark$  (4)

4.3  $A = P(1 + i)^n$   
 $28\,000 = 15\,000(1 + i)^{2 \times 5} \checkmark$   
 $\frac{28\,000}{15\,000} = (1 + i)^{10}$   
 $1 + i = \sqrt[10]{\frac{28\,000}{15\,000}}$   
 $i = \sqrt[10]{\frac{28\,000}{15\,000}} - 1 = 0,0644044 \checkmark$   
 $\frac{r}{2 \times 100} = 0,0644044$   
 $r = 0,0644044 \times 200$   
 $r = 12,88\% \checkmark$  (4)

**[15]**

**Total: [50]**

Exemplar Assessments Memorandum

Time: 3 hours

Term 4: Final Examination Paper 1

- If a candidate answers a question TWICE, mark the FIRST attempt ONLY.
- Consistent accuracy applies in ALL aspects of the marking guideline.
- If a candidate crossed out an attempt of a question and did not redo the question, mark the crossed-out attempt.
- The mark for substitution is awarded for substitution into the correct formula.

1.1.1  $x = 0 \checkmark$  or  $x = -\frac{1}{2} \checkmark$  (2)

1.1.2  $3x^2 - 2x - 4 = 0 \checkmark$   
 $x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(3)(-4)}}{2(3)} \checkmark$   
 $x = -0,87 \checkmark$  or  $x = 1,54 \checkmark$  (4)

1.1.3  $\sqrt{x-1} = x-1 \checkmark$   
 $x-1 = x^2 - 2x + 1 \checkmark$   
 $x^2 - 3x + 2 = 0 \checkmark$   
 $(x-1)(x-2) = 0 \checkmark$   
 $x = 1$  or  $x = 2 \checkmark$   
 check: both solutions (5)

1.1.4  $x^2 - 3x - 10 \geq 0 \checkmark$   
 $(x+2)(x-5) \geq 0 \checkmark$   
 $x \leq -2 \checkmark$  or  $x \geq 5 \checkmark$  (4)

1.1.5  $3^x(3^3 - 3^2) = 486 \checkmark$   
 $3^x = \frac{486}{27-9} \checkmark = 27$   
 $3^x = 3^3 \checkmark$   
 $x = 3 \checkmark$  (4)

1.1.6  $2(2^x)^2 - 9 \cdot 2^x + 4 = 0$   
 $(2^x - 1)(2^x - 4) = 0 \checkmark$   
 $2^x = \frac{1}{2}$  or  $2^x = 4 \checkmark$   
 $2^x = 2^{-1}$  or  $2^x = 2^2 \checkmark$   
 $x = -1 \checkmark$  or  $x = 2 \checkmark$  (5)

1.2  $2x - 7 = y \checkmark$   
 $x^2 + x(2x - 7) + (2x - 7)^2 = 21 \checkmark$   
 $x^2 + 2x^2 - 7x + 4x^2 - 28x + 49 - 21 = 0 \checkmark$   
 $7x^2 - 35x + 28 = 0$   
 $x^2 - 5x + 4 = 0 \checkmark$   
 $(x - 4)(x - 1) = 0$   
 $x = 4$  or  $x = 1 \checkmark$   
 $y = 1$  or  $y = -5 \checkmark$  (6)

## Exemplar Assessments Memorandum

1.3.1  $\Delta = 0$  for equal roots

$$\Delta = 2p + 5$$

$$0 = 2p + 5 \checkmark$$

$$p = -\frac{5}{2} \checkmark \quad (2)$$

1.3.2  $\Delta < 0$  for non real roots

$$2p + 5 < 0$$

$$p < -\frac{5}{2} \checkmark \quad (1)$$

**[33]**

$$2.1.1 \left(\frac{27x^7}{x}\right)^{\frac{2}{3}} = \left(\frac{3^3x^7}{x}\right)^{\frac{2}{3}} \checkmark = 3^{3 \times \frac{2}{3}} x^{6 \times \frac{2}{3}} \checkmark = 3^2 x^4 = 9x^4 \checkmark \quad (3)$$

$$2.1.2 \frac{\sqrt{48} - \sqrt{32}}{\sqrt{12} - \sqrt{8}} = \frac{4\sqrt{3} - 4\sqrt{2}}{2\sqrt{3} - 2\sqrt{2}} \checkmark \checkmark = \frac{4(\sqrt{3} - \sqrt{2})}{2(\sqrt{3} - \sqrt{2})} \checkmark \checkmark = 2 \checkmark \quad (5)$$

$$2.2 \sqrt{10\,002^2 - 10\,000 \times 10\,004}$$

$$\text{Let } x = 10\,000: \sqrt{(x+2)^2 - x(x+4)} \checkmark$$

$$= \sqrt{x^2 + 4x + 4 - x^2 - 4x} \checkmark = \sqrt{4} \checkmark = 2 \checkmark \quad (4)$$

**[12]**

$$3.1.1 T_n = 11n \checkmark + 31 \checkmark \quad (2)$$

$$3.1.2 T_{10} = 110 + 31 \checkmark = 141 \checkmark \quad (2)$$

$$3.1.3 11n + 31 = 702 \checkmark$$

$$n = 61 \checkmark \quad (2)$$

$$3.2.1 \frac{16}{15} \cdot \frac{19}{18} \checkmark \checkmark \quad (2)$$

$$3.2.2 T_n = \frac{3n+1}{3n} \checkmark \checkmark \quad (2)$$

**[10]**

$$4.1.1 13 - 17 = -4; 9 - 13 = -4$$

Difference is  $-4$

$$T_4 = 9 - 4 = 5 \checkmark \quad (1)$$

$$4.1.2 T_n = a + (n - 1)d$$

$$T_n = 17 + (n - 1)(-4) \checkmark$$

$$T_n = 17 - 4n + 4 = -4n + 21 \checkmark \quad (2)$$

$$4.1.3 T_n = 21 - 4n$$

$$-83 = 21 - 4n \checkmark$$

$$-104 = -4n \checkmark \quad (3)$$

$n = 26$  The term will be the 26th term  $\checkmark$

$$4.1.4 Q_{470} - Q_{469}$$

$T_{469}$  of linear sequence  $\checkmark$

$$21 - 4(469) \checkmark$$

$$21 - 1\,876 = -1\,855 \checkmark \quad (3)$$

Exemplar Assessments Memorandum

- 4.2  $2a = 2$   
 $a = 1 \checkmark$   
 $T_5 = 29$   
 $1(5)^2 + 5b + c = 29$   
 $25 + 5b + c = 29$   
 $5b + c = 4 \checkmark$   
 and  $T_{17} = 29$   
 $1(17) + 17b + c = 2 + 9 \checkmark$   
 $289 + 17b + c = 29$   
 $17b + c = -260$   
 $c = 4 - 5b \checkmark$   
 $17b + (4 - 5b) = -260 \checkmark$   
 $12b = -264$   
 $b = -22 \checkmark$   
 $c = 4 - 5b$   
 $c = 114 \checkmark$   
 $T_n = n^2 - 22n + 114 \checkmark$  (8)  
**[16]**
- 5.1  $-4 = a(1 - 3)(1 + 1) \checkmark$   
 $4 = -4a$   
 $a = 1 \checkmark$  (2)
- 5.2  $0 = x^2 - 2x - 3 - (-x - 5)$   
 $0 = x^2 - x + 2 \checkmark$   
 $\Delta = b^2 - 4ac$  with  $a = 1$ ,  $b = -1$  and  $c = 2$   
 $\Delta = (-1)^2 - 4(1)(2) = -7 \checkmark$   
 The roots are imaginary ( $\Delta < 0$ ).  $\checkmark$   
 This confirms that the two graphs do not intersect. (3)
- 5.3  $f\left(-\frac{1}{2}\right) = \frac{1}{2} - 5 = -4\frac{1}{2} \checkmark$   
 $g\left(-\frac{1}{2}\right) = \left(-\frac{1}{2}\right)^2 - 2\left(-\frac{1}{2}\right) - 3 \checkmark = -1\frac{3}{4} \checkmark$   
 $FG = -1\frac{3}{4} - \left(-4\frac{1}{2}\right) \checkmark = 2\frac{3}{4}$  units  $\checkmark$  (5)
- 5.4  $f(x) = 0$  when  $x = -5$ , E =  $(-5; 0) \checkmark$   
 $g(x) = 0$  when  $x = 3$  (at B) or  $x = -1$  (at A)  $\checkmark$   
 EB = 8 units  $\checkmark$  (3)
- 5.5  $g(x)$  is decreasing for  $x < 1 \checkmark$  (1)  
**[19]**

### Exemplar Assessments Memorandum

6.1  $p = 2$  ✓ and  $q = -1$  ✓

$$f(x) = \frac{k}{x+2} - 1$$

Substitute B(0; -3): ✓  $-3 = \frac{k}{0+2} - 1$  ✓

$$k = -4$$
 ✓

(5)

6.2  $x = -2$  ✓ and  $y = -1$  ✓

(2)

6.3 The gradient of the axis of symmetry is  $m = \frac{-3+1}{0+2} = -1$  using points (-2; -1) and (0; -3).

The gradient of the axis of symmetry  $g(x)$  is  $-1$  ✓

$c = -3$ , the  $y$ -intercept ✓

$$g(x) = -x - 3$$

(2)

6.4  $y = x + c$  passes through (-2; -1) ✓

$$-1 = -2 + c \text{ gives } c = 1$$
 ✓

Axis of symmetry is  $y = x + 1$

(2)

6.5 C = (-4; -1) and B = (0; -3)

$$CB^2 = 4^2 + 4^2 = 32$$
 ✓

Pythagoras' Theorem

$$CB = \sqrt{32}$$
 ✓ =  $4\sqrt{2}$  ✓

By inspection: The coordinates of C are (-4; 1) ✓

Alternatively: At C:  $-\frac{4}{x+2} - 1 = -x - 3$

$$4 - (x + 2) = (-x - 3)(x + 2)$$

$$4 - x - 2 = -x^2 - 5x - 6$$

$$x^2 + 4x = 0$$

$$x(x + 4) = 0$$

$$x = 0 \text{ or } x = -4$$

At C,  $x = -4$  gives  $y = 1$

$$CB = \sqrt{(-4 - 0)^2 + (1 + 3)^2} = \sqrt{32}$$

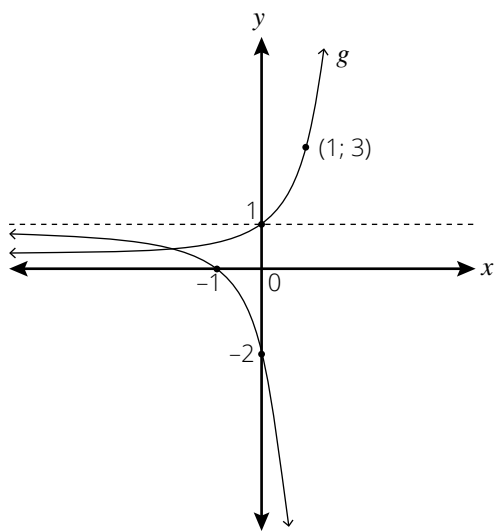
$$CB = 4\sqrt{2}$$

(4)

**[15]**

Exemplar Assessments Memorandum

7.1



✓✓  $g(x)$  ✓✓✓  $f(x)$

(5)

7.2.1  $y > 0$  ✓✓

(2)

7.2.2  $-f(x) = 3^{x+1} - 1$  ✓

$y > -1$  ✓✓

(3)

7.2.3 Reflection of  $g(x)$  in the  $y$ -axis is  $h(x) = 3^{-x}$  or  $h(x) = \left(\frac{1}{3}\right)^x$  ✓✓

(2)

**[12]**

8.1  $A = 140\,000 (1 - 0,14 \times 4)$  ✓ = R61 600 ✓

(3)

8.2  $A = 10\,000 \left(1 + \frac{0,084}{2}\right)^8 \left(1 + \frac{0,084}{12}\right)^{48}$  ✓  
 = R20 051,76, so interest earned is R10 051,76 ✓

(4)

8.3.1  $\left(1 + \frac{0,085}{12}\right)^{12}$  ✓ = 1,08839 ✓

Effective interest rate = 8,839% = 8,84% ✓

(3)

8.3.2  $14\,500(1 + 0,08839)^3$  ✓ = R18 694,83 ✓

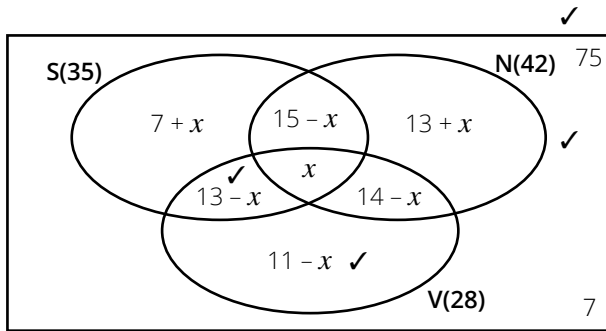
$(18\,694,83 - 5\,000) \left(1 + \frac{0,078}{4}\right)^8$  ✓ = R15 982,87 ✓

(5)

**[15]**

### Exemplar Assessments Memorandum

9.1 Let the number of learners who do all sports be  $x$ . ✓



$$7 + x + 15 - x + 13 + x + 13 - x + x + 14 - x + 11 - x + 7 = 75$$

$$80 - x = 75$$

$x = 5$ , five learners did all the sports. ✓

9.2 If  $x = 5$  and for Soccer only  $(7 + x) = 12$  learners ✓✓

9.3.1  $P(N) = \frac{18}{75} = \frac{6}{25}$  ✓✓

9.3.2  $P(N/S) = \frac{15}{35} = \frac{3}{7}$  (using soccer as a sample space) ✓✓

9.3.3  $P(\text{not } V) = 1 - P(V) = 1 - \frac{28}{75} = \frac{47}{75}$  ✓✓

[14]

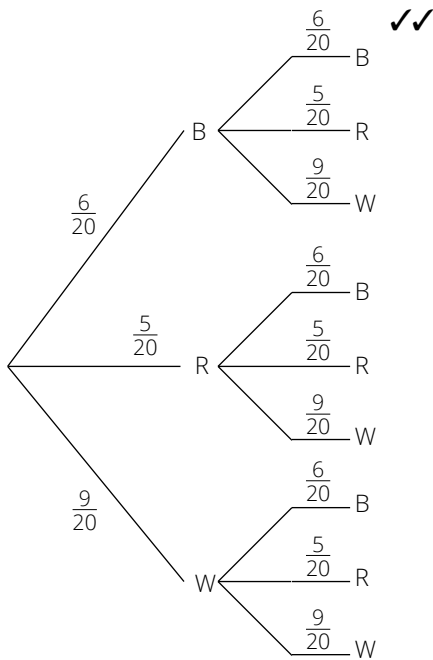
10.1  $P(A \text{ and } B) = P(A) + P(B) - P(A \text{ or } B)$

$$P(A \text{ and } B) = \frac{2}{3} + \frac{2}{5} - \frac{4}{5} ✓$$

$$P(A \text{ and } B) = \frac{4}{15} ✓$$

(2)

10.2



$$P(\text{both white}) = \frac{7}{21} \times \frac{6}{20} = \frac{1}{10} ✓✓$$

(4)

[6]

Total: [150]



Exemplar Assessments Memorandum

Time: 3 hours

Term 4: Final Examination Paper 2

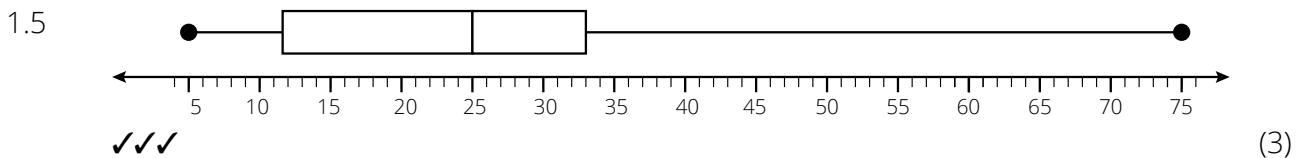
- If a candidate answers a question TWICE, mark the FIRST attempt ONLY.
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- The mark for substitution is awarded for substitution into the correct formula.

1.1 Range =  $75 - 5 = 70$  ✓ (1)

1.2 Standard deviation =  $19,56$  ✓✓ (2)

1.3 Median =  $25$  ✓ (1)

1.4  $Q_1 = \frac{8 + 15}{2} = 11,5$  ✓  
 $Q_2 = \frac{31 + 36}{2} = 33,5$  ✓  
 $IQR = Q_3 - Q_1 = 33,5 - 11,5 = 22$  ✓ (3)



1.6 Skewed to the right/Positively skewed ✓ (1)

1.7 Outlier =  $75$  ✓ (1)

[12]

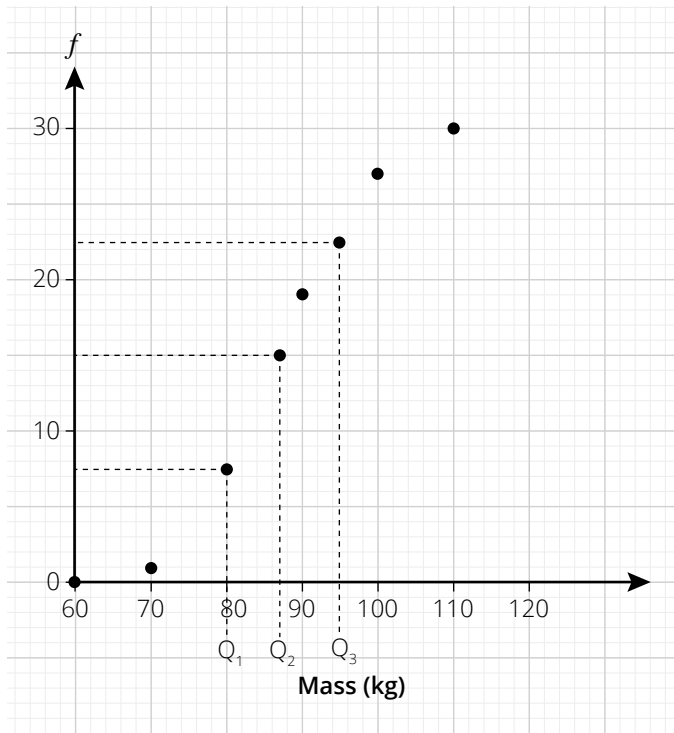
2.1

Mass (kg)	Frequency	Cumulative Frequency
$60 \leq x < 70$	1	1
$70 \leq x < 80$	6	7
$80 \leq x < 90$	11	18
$90 \leq x < 100$	9	27
$100 \leq x < 110$	3	30

- ✓ for Frequency
- ✓ for Cumulative frequency (2)

### Exemplar Assessments Memorandum

2.2



✓✓✓

(3)

2.3 Mean mass =  $\frac{2\ 595}{30} \checkmark = 86\frac{1}{2}$  kg ✓ (2)

2.4 Standard deviation = 8,51

$\bar{x} - 1$  standard deviation = 77,99 kg and

$\bar{x} + 1$  standard deviation = 95,01 kg ✓

21 rugby players have a mass within 1 standard deviation of the mean. ✓

(2)

**[9]**

3.1.1  $m_{DF} = -\frac{3-2}{-5+1} = \frac{5}{4} \checkmark \checkmark$

$m_{DE} = -\frac{2-2}{4+1} = -\frac{4}{5} \checkmark \checkmark$

(4)

3.1.2  $m_{DF} \times m_{DE} = \frac{5}{4} \times -\frac{4}{5} = -1 \checkmark \checkmark$

DE and DF are perpendicular to each other.

(2)

3.1.3 DE:  $y = -\frac{4}{5}x + c \checkmark$

Substitute a point on DE to find  $c$ :

$(-1; 2) = -\frac{4}{5}(-1) + c \checkmark$ , gives  $c = \frac{6}{5}$

DE:  $y = -\frac{4}{5}x + \frac{6}{5} \checkmark$

(3)

3.1.4 Substitute  $x = 6$  into DE to find  $y$ .

$y = \left(-\frac{4}{5}\right)6 + \frac{6}{5} \checkmark = -\frac{18}{5} \checkmark$

(2)

3.1.5  $DF = \sqrt{(-1+5)^2 + (2+3)^2} = \sqrt{41} \checkmark \checkmark$

$DE = \sqrt{(-1-4)^2 + (2+2)^2} = \sqrt{41} \checkmark \checkmark$

(4)

Exemplar Assessments Memorandum

3.1.6 Area  $\triangle DEF = \frac{1}{2}(\sqrt{41} \times \sqrt{41}) \checkmark = 20,5 \text{ units}^2 \checkmark$  (2)

3.2.1 RS:  $\sqrt{(x - 10)^2 + (-9 - 3)^2} = 15 \checkmark$   
 $x^2 + 20x + 100 + 144 = 225 \checkmark$   
 $x^2 - 20x + 19 = 0 \checkmark$   
 $(x - 19)(x - 1) = 0 \checkmark$

$x = 1, x \neq 19$  from sketch  $\checkmark$  (5)

3.2.2 T =  $(\frac{10+1}{2}, \frac{3-9}{2}) = (\frac{11}{2}, -3) \checkmark \checkmark$  (2)

3.2.3  $m_{PT} = \frac{-3-1}{\frac{11}{2}-(-4)} = -\frac{8}{19} \checkmark \checkmark$  (2)

3.2.4  $m_{RS} = \frac{3-(-9)}{10-1} = \frac{12}{9} = \frac{4}{3} \checkmark$   
 $m_{QR} = -\frac{3}{4} \checkmark (m_{RS} \times m_{QR} = -1)$   
 $\frac{y-(-9)}{-7-1} = -\frac{3}{4} \checkmark$

$\frac{y+9}{-8} = -\frac{3}{4}$  and  $y = -3 \checkmark$  (4)

3.2.5  $m_{QR} = -\frac{3}{4}$  and  $m_{PT} = -\frac{8}{19} \checkmark$   
 QR is not parallel to PT. (Gradients are not equal)  $\checkmark$  (2)

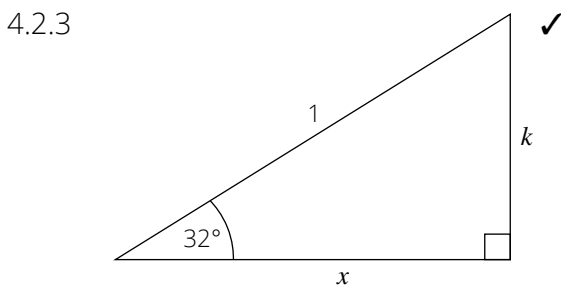
[32]

4.1.1  $\frac{\sin(180^\circ - 80^\circ) \cdot \tan^2(180^\circ + 45^\circ)}{\tan 30^\circ \cdot \cos 10^\circ \cdot \sin(180^\circ - 60^\circ)}$   
 $= \frac{\sin 80^\circ \cdot \tan^2 45^\circ}{\tan 30^\circ \cdot \cos 10^\circ \cdot \sin 60^\circ}$   
 $= \frac{\cos 10^\circ \cdot (1)^2}{(\frac{1}{\sqrt{3}}) \cdot \cos 10^\circ \cdot (\frac{\sqrt{3}}{2})} = \frac{1}{\frac{1}{2}} = 2 \checkmark$  (6)

4.1.2  $\frac{\cos x \cdot \sin^2 x}{(-\cos x) \cdot (-\sin x) \cdot (\frac{\sin x}{\cos x}) \cdot \cos x} = 1 \checkmark$  (7)

4.2.1  $\cos 58^\circ = \sin(90^\circ - 58^\circ) = \sin 32^\circ = k \checkmark$  (1)

4.2.2  $\sin 212^\circ = \sin(180^\circ + 32^\circ) = -\sin 32^\circ = -k \checkmark$  (1)



$x^2 = 1^2 - k^2$  Pythagoras Theorem

$x = \sqrt{1 - k^2} \checkmark$

$\tan 32^\circ = \frac{k}{\sqrt{1 - k^2}} \checkmark$  (3)

### Exemplar Assessments Memorandum

$$\begin{aligned}
 4.3 \quad \text{RHS} &= \left(\frac{1}{\cos\theta} - \frac{\sin\theta}{\cos\theta}\right)^2 = \left(\frac{1-\sin\theta}{\cos\theta}\right)\left(\frac{1-\sin\theta}{\cos\theta}\right) \checkmark \\
 &= \frac{(1-\sin\theta)(1-\sin\theta)}{\cos^2\theta} = \frac{(1-\sin\theta)(1-\sin\theta)}{1-\sin^2\theta} \checkmark = \frac{(1-\sin\theta)(1-\sin\theta)}{(1-\sin\theta)(1+\sin\theta)} \checkmark = \frac{1-\sin\theta}{1+\sin\theta} \checkmark = \text{LHS} \quad (4)
 \end{aligned}$$

$$\begin{aligned}
 \text{LHS} &= \frac{\cos x}{1+\sin x} + \tan x \\
 &= \frac{\cos x}{1+\sin x} + \frac{\sin x}{\cos x} \checkmark \\
 &= \frac{\cos^2 x + \sin x(1+\sin x)}{\cos x(1+\sin x)} \checkmark = \frac{\cos^2 x + \sin x + \sin^2 x}{\cos x(1+\sin x)} \checkmark = \frac{1+\sin x}{\cos x(1+\sin x)} \checkmark = \frac{1}{\cos x} = \text{RHS} \checkmark \quad (5)
 \end{aligned}$$

4.4 Identity undefined if  $\cos x = 0$  ✓

Reference angle =  $90^\circ$

Quadrant 1:  $x = 90^\circ + 360k$  ✓

Quadrant 2:  $x = 270^\circ + 360k, k \in \mathbb{Z}$  ✓ (3)

4.5  $\sin(x + 10^\circ) = \cos(x - 30^\circ) = \sin[90^\circ - (x - 30^\circ)] = \sin(120^\circ - x)$

Quadrant 1:  $(x + 10^\circ) = (120^\circ - x) + 360^\circ k, k \in \mathbb{Z}$

$$2x = 110^\circ + 360^\circ k, k \in \mathbb{Z}$$

$$x = 55^\circ + 180^\circ k, k \in \mathbb{Z}$$

Quadrant 2:  $(x + 10^\circ) = 180^\circ - (120^\circ - x) + 360^\circ k, k \in \mathbb{Z}$

$$x + 10^\circ = 60^\circ + x \text{ No solution}$$

Final solution:  $x = -125^\circ; 55^\circ$  (7)

**[38]**

5.1  $f(90) = a \sin(90^\circ) = 2$  and  $g(360^\circ) = 0$

$$a = 2 \checkmark \text{ and } b = \frac{1}{2} \checkmark \quad (2)$$

5.2  $P(120^\circ; \sqrt{3}) \checkmark$  and  $Q(240^\circ; -\sqrt{3})$  (2)

5.3  $120^\circ \leq x < 180^\circ \checkmark\checkmark$  and  $240^\circ \leq x \leq 360^\circ \checkmark\checkmark$  (4)

5.4  $x = 180^\circ \checkmark$  (1)

**[9]**

$$6.1 \quad \frac{CD}{\sin 80^\circ} = \frac{52}{\sin 60^\circ} \checkmark$$

$$CD = \frac{52 \sin 80^\circ}{\sin 60^\circ} \checkmark = 59,13 \text{ m} \checkmark \quad (3)$$

$$6.2 \quad AD^2 = 74^2 + 52^2 - 2(74)(52) \cos 36^\circ \checkmark\checkmark$$

$$AD = \sqrt{1953,805\dots} \checkmark = 44,20 \text{ m} \quad (3)$$

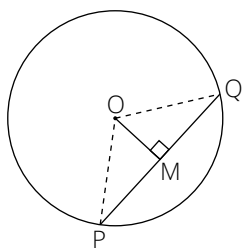
6.3  $\widehat{BDC} = 40^\circ \checkmark$  (sum of angles in  $\triangle BDC$ ) ✓

$$\begin{aligned}
 \text{Area of ABCD} &= \left(\frac{1}{2}\right)74 \times 52 \times \sin 36^\circ \checkmark + \left(\frac{1}{2}\right)59,13 \times 52 \times \sin 40^\circ \checkmark \\
 &= 2\,119,11 \text{ m}^2 \checkmark \quad (5)
 \end{aligned}$$

**[11]**

Exemplar Assessments Memorandum

7.1



(Note: Instead of Prove you may write RTP, which means “required to prove”.)

Prove:  $PM = MQ$  (Radii)

Construction: Draw radii  $OP$  and  $OQ$ . ✓

Proof: In  $\triangle OPM$  and  $\triangle OQM$ :  $OP = OQ$  ✓ (Given  $OM \perp PQ$ )

$OM$  is common. ✓ (RHS (right angle, hypotenuse, side))

$\widehat{OMP} = 90^\circ = \widehat{OMQ}$  ✓ ( $\cong \triangle s$ ) ✓

$\triangle OPM \cong \triangle OQM$  ✓

$PM = MQ$  ✓

(6)

7.2

$AB = 10$  cm

Given

$AD = DB = 5$  cm ✓

$OC \perp AB$  ✓

$OA = 13$  cm

Given

$OD = 12$  cm ✓

Pythagoras' Theorem in  $\triangle OAD$  ✓

$\therefore DC = 1$  cm ✓

$OC = 13$  cm =  $OA$  radii ✓

(6)

7.3

$\widehat{ACP} = 90^\circ$

$\angle$ s in semi-circle

Let  $\widehat{BCP} = x$

$\angle$  at centre =  $2(\angle$  at circumference) ✓

$\widehat{BAP} = x$  ✓

$\angle$ s subtended by  $BP$  ✓ ( $\angle$ s in same seg)

$\widehat{ABO} = x$  ✓

Radii  $OA = OB$ ;  $\angle$ s opp equal sides ✓

and  $\widehat{DCB} = x$  ✓

Chord  $BC$  bisects  $\widehat{DCP}$  ✓

$\therefore \widehat{DAE} = x$  ✓

Exterior  $\angle$  cyclic quadrilateral  $ABCD$

$\widehat{PAC} = x$  ✓

$\angle$ s sum of  $\triangle PAC$  ✓

(10)

[22]

8.1

RTP:  $\widehat{D} + \widehat{F} = 180^\circ$

Construction: Draw radii  $EO$  and  $OG$ . ✓

Proof: Let reflex  $\widehat{EOG} = 2x$  ✓

$\widehat{GDE} = x$  ✓

$\angle$  at centre =  $2(\angle$  at circumference)

$\widehat{EOG} = 360^\circ - 2x$  ✓

Angles around a point

$\widehat{F} = 180^\circ - x$  ✓

$\angle$  at centre =  $2(\angle$  at circumference)

$\widehat{GDE} + \widehat{F} = x + 180^\circ - x$

$\therefore \widehat{D} + \widehat{F} = 180^\circ$  ✓

(6)

## Exemplar Assessments Memorandum

8.2	$\widehat{GDE} = x$ $\widehat{CDE} = 180^\circ - x \checkmark$ $\widehat{F} = 180^\circ - x \checkmark$ $\therefore \widehat{CDE} = \widehat{F}$	Proved above CDG straight line ( $\angle$ s on str line) $\checkmark$ Both equal ( $180^\circ - x$ ) (opp $\angle$ s of cyclic quad) $\checkmark$ Both equal ( $180^\circ - x$ ) $\checkmark$	(5) <b>[11]</b>
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9.1	Use Pythagoras' Theorem to calculate the missing length: $5^2 + 5^2 = s^2$ $s = \sqrt{50} = 7,07 \text{ cm} \checkmark$ $TSA = 2\left(\frac{1}{2}\right)(10 \times 5) + (10 \times 20) + 2(7,07 \times 20) \checkmark = 532,8 \text{ cm}^2 \checkmark$ Volume = area of cross-section $\times$ length $\checkmark$ $Volume = \frac{1}{2}(10 \times 5)(20) \checkmark = 500 \text{ cm}^3 \checkmark$	(6) <b>[6]</b> <b>Total: [150]</b>
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