

2023 SUBJECT WORKBOOK

Grade 10

$f(x)=x^2$ **MATHEMATICS**

A joint initiative between the Western Cape Education Department and Stellenbosch University.

INTRODUCTION

Dear Grade 10 Learner

In 2023 there will be 14 live grade 10 Telematics sessions, 7 of these sessions are in English and 7 in Afrikaans.

This workbook contain material for all the Grade 10 sessions scheduled.

Please email, school@sun.ac.za with your name, surname, email and school name to register to obtain a username and password. You will then be able to access all previously recorded Telematics sessions and materials on other Topics from the Telematics Schools Project website, <https://schools.sun.ac.za/>. Please note that accessing these recordings from this website is zero-rated.

In the Telematic lesson, the presenters will provide you with a summary of the important concepts and together with you they will work though some of the exercises. You are encouraged to come prepared, have a pen and enough paper (ideally a hard cover exercise book) and a scientific calculator.

You are also encouraged to participate fully in the lesson by asking questions and working out the exercises, and where you are asked to do so, sms or e-mail your answers to the studio.

Remember:” Success is not an event, it is the result of regular and consistent hard work”.

GOODLUCK, Wishing you all the success you deserve!

Session/Sessie	Date/Datum	Time/Tyd	Topic/Onderwerp
1.	01/02/2023	16h00-17h00	Quadratic Trinomial
2.	02/02/2023	16h00-17h00	Kwadratiese Drieterm
3.	06/02/2023	16h00-17h00	Solving Equations Simultaneously
4.	07/02/2023	16h00-17h00	Gelyktydige vergelykings
5.	03/05/2023	15h00-16h00	Trigonometry
6.	04/05/2023	15h00-16h00	Trigonometrie
7.	31/07/2023	16h00-17h00	Trigonometry 2D application
8.	01/08/2023	16h00-17h00	Trigonometrie 2D toepassing
9.	02/08/2023	15h00-16h00	Trigonometry CAST- diagram
10.	03/08/2023	15h00-16h00	Trigonometrie CAST-diagram
11.	06/11/2023	16h00-17h00	Paper 1
12.	07/11/2023	16h00-17h00	Vraestel 1
13.	08/11/2023	16h00-17h00	Paper 2
14.	09/11/2023	16h00-17h00	Vraestel 2

SESSION 1 | QUADRATIC TRINOMIAL



CLASS DISCUSSIONS

FACTORIZING QUADRATIC TRINOMIAL

$$\begin{aligned} +ve \times +ve &= +ve \\ -ve \times -ve &= +ve \\ +ve \times -ve &= -ve \\ -ve \times +ve &= -ve \end{aligned}$$

Product of binomials:

$$\begin{aligned} (a + b)(a + b) &= a^2 + 2ab + b^2 \\ (a - b)(a - b) &= a^2 - 2ab + b^2 \\ (a + b)(a - b) &= a^2 - b^2 \end{aligned}$$

Standard form

$$ax^2 + bx + c$$

Factorization

Factorisation is the “reverse” operation to Products or Expansion.

Let's expand the product: $(mx + p)(nx + q)$

$$\begin{aligned} \text{We then get :} &= mnx^2 + pnx + mqx + pq \\ &= mnx^2 + (pn + mq)x + pq \end{aligned}$$

Factorise

trinomial

Question 01

Determine the product of each of the following:

- $(x + 2)(x + 2)$
- $(x - 5)(x - 5)$
- $(x + 7)(x + 5)$
- $(x - 3)(x - 4)$
- $(x + 2)(x - 5)$
- $(x - 3)(x + 7)$

Question 02

Match the expressions in column A with expressions in column B

A:

- $(x - 1)^2$
- $(x + 3)(2x + 3)$
- $(2x - 1)(x + 3)$
- $(2x + 1)(x - 3)$

B:

- $2x^2 + 5x - 3$
- $2x^2 - 5x - 3$
- $x^2 - 2x + 1$
- $2x^2 + 9x + 9$

Question 03

Match column C with expressions in column D.

C:

- $x^2 + 16x + 64$
- $3x^2 - 11x + 10$
- $2x^2 - 7x - 4$
- $3x^2 + y - 10$

D:

- $(..+..)(..-..)$
- $(..-..)(..+..)$
- $(..-..)(..-..)$
- $(..+..)(..+..)$

SESSION 1 | QUADRATIC TRINOMIAL

Question 04

Factorise the following:

- a) $x^2 + 9x + 18$
- b) $x^2 - 7x + 10$
- c) $x^2 + 2x - 15$
- d) $x^2 - 7x - 18$

Answer 04

Question 05

Factorise the following:

- a) $2x^2 + 9x + 4$
- b) $6x^2 - 11x + 3$
- c) $3x^2 - 11x + 10$
- d) $10x^2 + 9x + 2$
- e) $2x^2 + 7x - 4$
- f) $6x^2 - 7x - 3$
- g) $3x^2 - x - 10$
- h) $10x^2 + x - 2$

Answer 05

SESSION 1 | QUADRATIC TRINOMIAL



CLASS DISCUSSIONS

SOLVING QUADRATIC EQUATION

TAKE NOTE :

$$a \cdot b = 0$$

$$\Rightarrow a = 0 \text{ or } b = 0$$

STEPS:

1. Write the quadratic equation in standard form.
2. Factorise
3. Then apply.

$$a \cdot b = 0$$

$$\Rightarrow a = 0 \text{ or } b = 0$$

Take note of following:

1. $x^2 \geq 0$ for all real values
2. $\frac{x}{0}$ is undefined

Standard form

$$ax^2 + bx + c = 0$$

Question 01

 Solve for x :

a) $(x + 2)(x - 3) = 0$

b) $x^2 - 5x - 6 = 0$

c) $(2x - 1)(x + 2) = 25$

d) $x^2 = -5x$

e) $x^2 + 4 = 0$

f) $\frac{x^2 - 2x - 3}{x - 3} = 2$

SESSION 3 | Solving equations simultaneously

Solving Equations simultaneously: This is done when you given two equations with two variables/unknowns and you want to determine the values of the unknowns for which both equations are satisfied.

Consider the following two equations:

$$\begin{aligned}x + y &= 2 \\x - y &= 4\end{aligned}$$

There are 2 methods to solve equations simultaneous Algebraically:

- Substitution
- Elimination

Answer:

Method 1:

Method 2:

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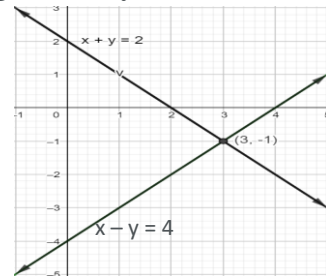
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We can solve a system of simultaneous equations graphically and algebraically.

Graphically: We can draw the graphs representing the 2 equations (straight lines), see the sketch. The point where The two lines intersect is the solution to the set of equations.



Questions 01

Solve for x and y simultaneously:

- $x + 2y = 5$ and $x - y = \frac{1}{2}$
- $2x - 3y = 6$ and $6y + 3x = 11$
- $3x - y = 1$ and $x + 2y = 5$
- $-3x + 4y = 18$ and $4x + y = -5$
- $y = 2x + 3$ and $y = -3x - 7$
- $3x - 2y = 0$ and $3x - 4y = -1$
- $5x - 2y = 6$ and $3x + 4y = 14$
- $\frac{x+3}{2} + \frac{y-2}{4} = \frac{11}{4}$ and $\frac{2x-1}{3} + \frac{y+3}{2} = 4$
- $y = -4x + 12$ and $y = 4x^2 - 8x - 3$
- $\frac{6}{x} - \frac{1}{y} = 4$ and $\frac{9}{x} + 1 = \frac{-2}{y}$

SESSION 3 | Word Problems



CLASS DISCUSSIONS

Solving Word Problems

To solve word problems:

- READ the question three times.
- Let x be one of the unknowns (usually what was asked) – if more than 1, make the smallest x
- Now write the other unknown in terms of x (you can also make it y and work with simultaneous equations)
- Set up equations from the information
- Solve for x (and y)
- Check the validity of your answer(s)

Key words:

Addition: sum, added to, increased by, more than, together, etc.

Subtraction: difference, subtracted, decreased by, less than, take away, etc.

Multiplication: multiplied by, times, twice, trice, double, product, etc.

Division: divided by, quotient, share among, etc.

Equals: is, give, was, equal, in total, becomes, etc.



Distance = speed \times time

Question 02

a) The sum of 2 consecutive numbers is 89. What are the numbers?

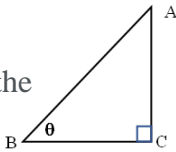
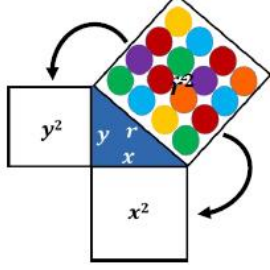
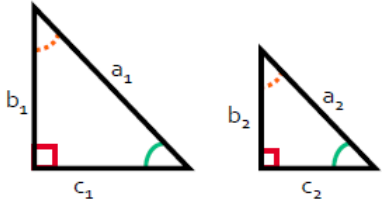
b) A father and his son are 36 years old altogether. 7 years from now, the father will be 4 times the age of his son then. What are their ages now?

c) A farmer bought sheep and cattle for an amount of R53 800. The price of sheep was R250 a piece and the cattle were R730 each. If he bought 100 animals, how many of each did he buy?

d) A rectangle is 5 m longer than it is wide. If the perimeter of the rectangle is 30 m, calculate its length and breadth.

e) Siya walked to the hall at 4 km/h and ran back home at 9 km/h. If it took him 4 hours and 20 minutes to get to the hall and back, how far was he from the hall?

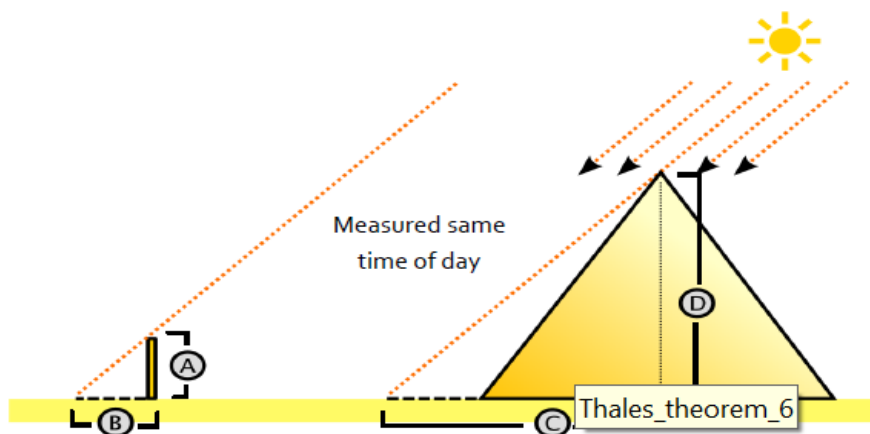
SESSION 5 | TRIGONOMETRY

Term	Explanation
Trigonometry	Trigonometry is a field of mathematics that studies the relationship between angles and side lengths of a triangle. The word ‘trigonometry’ comes from the Greek word trigonon, meaning triangle and metron, meaning measure. Greek letters are often used to represent the size of angles
Right-angled triangle	This is a right angled triangle. One of the angles is a 90° (right angle) angle. 
Pythagoras	In the given right angled triangle the angle between sides x and y is 90° . Therefore $x^2 + y^2 = z^2$ 
Similar Triangles	These are triangles where the corresponding angles of the two triangles are all equal, therefore the side lengths are proportional. 

This principal of similar triangles was used by Thales of Miletus to measure the height of the great Pyramid of Egypt.

Side lengths A and B form a similar triangle with side length C and D.

Therefore side length B is proportional to C and side length A is proportional to D.

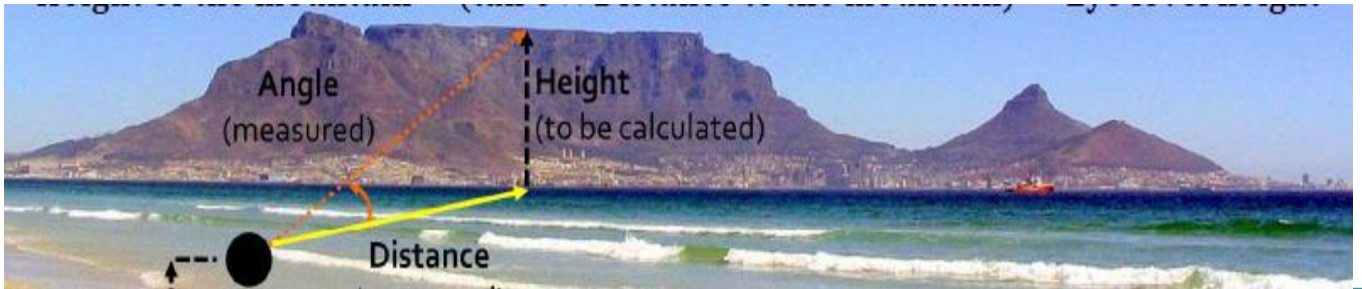


$$\frac{A}{B} = \frac{D}{C} \Rightarrow \text{Constant value}$$

$$\therefore D = C \times \left(\frac{A}{B}\right)$$

- A is the length of a pole
- C is the length of the pyramids shadow plus half the length of the pyramid's base
- B is the length of the pole's shadow
- D is the height of the pyramid

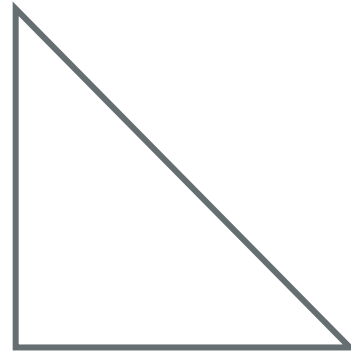
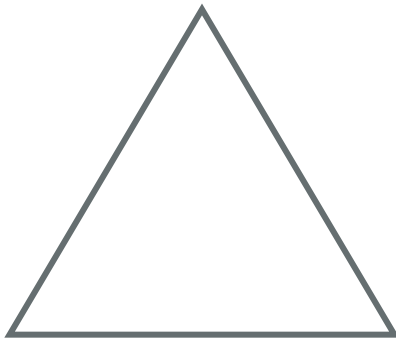
SESSION 5 | TRIGONOMETRY


Term
Explanation

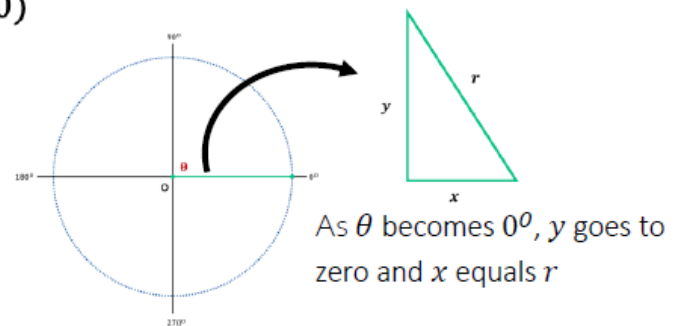
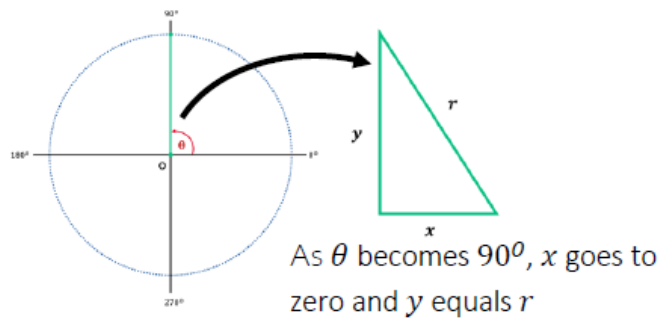
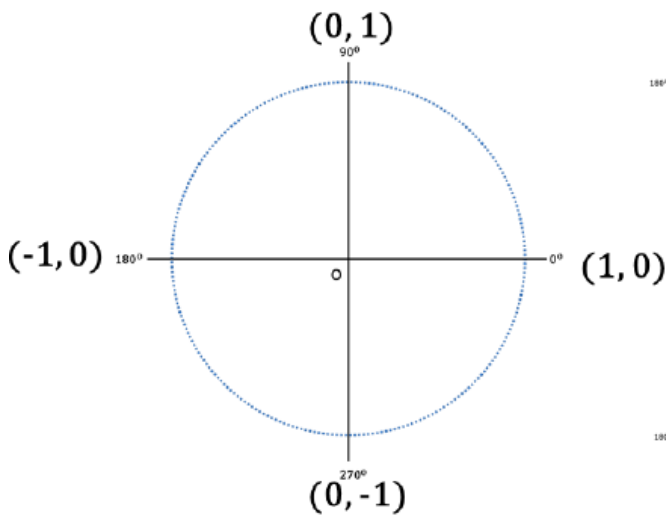
Hypotenuse	The hypotenuse is the longest side of a right-angled triangle.	
Adjacent side	The adjacent side, is a side in a given right-angled triangle of a particular angle which is not 90° and is one of the two sides forming the particular angle with the hypotenuse.	
Opposite Side	The opposite side, is the opposite side of a particular angle. This is the 3rd side after the adjacent and hypotenuse have been identified.	
Sine	$\sin \theta = \frac{\text{opposite side of } \theta}{\text{hypotenuse}}$	
Cosine	$\cos \theta = \frac{\text{adjacent side of } \theta}{\text{hypotenuse}}$	
Tangent	$\tan \theta = \frac{\text{opposite side of } \theta}{\text{adjacent side of } \theta}$	
Reciprocal	The reciprocal of 2 is $\frac{1}{2}$. The reciprocal of x , is $\frac{1}{x}$. The reciprocal $\frac{3}{4}$ is $\frac{4}{3}$. The product of a number and its reciprocal is 1.	
Cosecant	$\text{cosec } \theta = \frac{\text{hypotenuse}}{\text{opposite to } \theta}$	
Secant	$\sec \theta = \frac{\text{hypotenuse}}{\text{adjacent to } \theta}$	
Cotangent	$\cot \theta = \frac{\text{adjacent to } \theta}{\text{opposite to } \theta}$	

SESSION 5 | TRIGONOMETRY

Special Triangles: 60° ; 30° and 45°



Special Angles (0° , 90° , 180° and 360°)



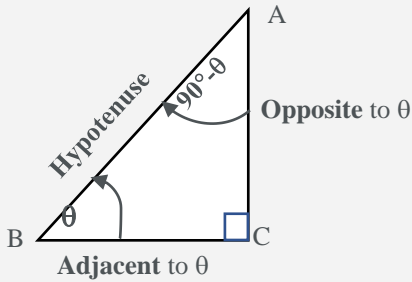
	Calculate the following using your calculator	Calculate the following using special triangles:
1.	$\sin 60^\circ =$ $\cos 60^\circ =$ $\tan 60^\circ =$	$\sin 60^\circ = \text{---} = \text{---}$ $\cos 60^\circ = \text{---} = \text{---}$ $\tan 60^\circ = \text{---} = \text{---} =$
2.	$\sin 30^\circ =$ $\cos 30^\circ =$ $\tan 30^\circ =$	$\sin 30^\circ = \text{---} = \text{---}$ $\cos 30^\circ = \text{---} = \text{---}$ $\tan 30^\circ = \text{---} = \text{---}$

SESSION 5 | TRIGONOMETRY



CLASS DISCUSSIONS

Special Triangles:
 $60^\circ; 30^\circ; 45^\circ; 90^\circ$ and 0°



$$\sin \theta = \frac{\text{opposite to } \theta}{\text{hypotenuse}}$$

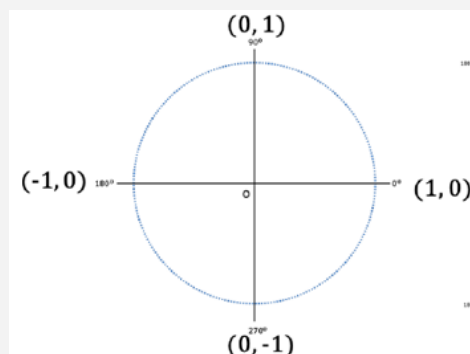
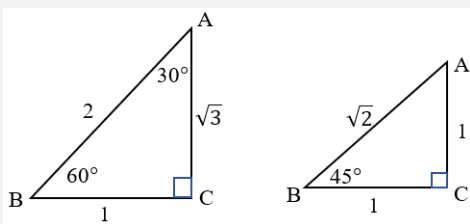
$$\cos \theta = \frac{\text{adjacent to } \theta}{\text{hypotenuse}}$$

$$\tan \theta = \frac{\text{opposite to } \theta}{\text{adjacent to } \theta}$$

$$\operatorname{cosec} \theta = \frac{\text{hypotenuse}}{\text{opposite to } \theta}$$

$$\sec \theta = \frac{\text{hypotenuse}}{\text{adjacent to } \theta}$$

$$\cot \theta = \frac{\text{adjacent to } \theta}{\text{opposite to } \theta}$$



Special Triangles

	Calculate the following using your calculator	Calculate the following using special triangles:
3.	$\sin 45^\circ =$ $\cos 45^\circ =$ $\tan 45^\circ =$	$\sin 45^\circ = \text{---} = \text{---}$ $\cos 45^\circ = \text{---} = \text{---}$ $\tan 45^\circ = \text{---} = \text{---} =$
4.	$\tan 30^\circ \times \cot 30^\circ$	$\tan 30^\circ \times \cot 30^\circ$
5.	$\tan^2 30^\circ$	$\tan^2 30^\circ$

Exercise:

Evaluate the following without the use of a calculator:

6. $\tan 30^\circ \times \cot 30^\circ$

7. $\tan^2 30^\circ$

8. $2 \sin 60^\circ$

9. $\cos 0^\circ - 2 \tan 45^\circ$

10. $\cos 0^\circ + \cos^2 45^\circ$

11. $\sin^2 60^\circ + \cos^2 60^\circ$

12. $\cos 30^\circ \tan 60^\circ$

13. $\frac{\sin 30^\circ}{\tan 30^\circ}$

14. $\cos 30^\circ \tan 60^\circ + \operatorname{cosec}^2 45^\circ \sin^2 60^\circ$

15. $\frac{\tan 45^\circ \cdot \sin 90^\circ}{\cos 30^\circ}$

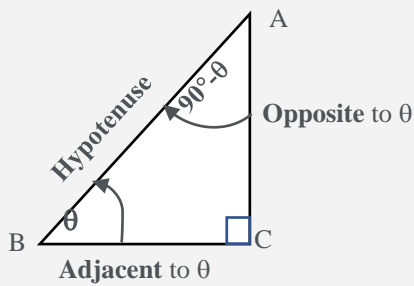
16. $\frac{\sin 60^\circ \tan 30^\circ}{\sec 45^\circ}$

SESSION 5 | TRIGONOMETRY



CLASS DISCUSSIONS

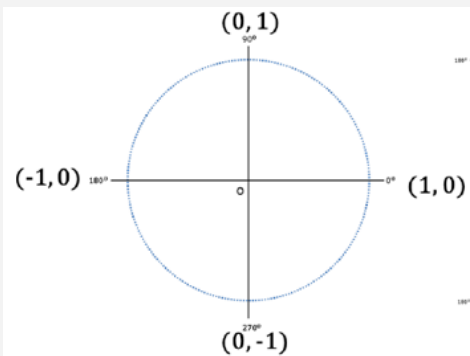
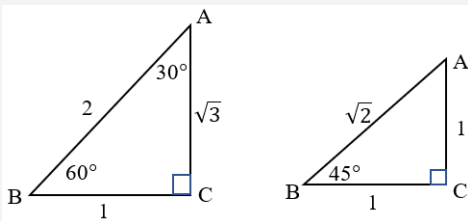
How to determine the angle if trigonometric ratio is given



$$\sin \theta = \frac{\text{opposite to } \theta}{\text{hypotenuse}}$$

$$\cos \theta = \frac{\text{adjacent to } \theta}{\text{hypotenuse}}$$

$$\tan \theta = \frac{\text{opposite to } \theta}{\text{adjacent to } \theta}$$



Special Angles

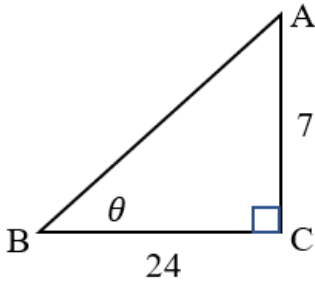
	Calculate θ using a calculator:	Calculate θ without using a calculator:
1.	$\sin \theta = \frac{\sqrt{3}}{2}$	$\sin \theta = \frac{\sqrt{3}}{2}$
2.	$\cos \theta = \frac{1}{2}$	$\cos \theta = \frac{1}{2}$
3.	$\tan \theta = \sqrt{3}$	$\tan \theta = \sqrt{3}$
4.	$\sin \theta = \frac{1}{\sqrt{2}}$	$\sin \theta = \frac{1}{\sqrt{2}}$
5.	$\cos \theta = \frac{1}{\sqrt{2}}$	$\cos \theta = \frac{1}{\sqrt{2}}$
6.	$\tan \theta = 1$	$\tan \theta = 1$
7.	$\sin \theta = 0$	$\sin \theta = 0$
8.	$\sin \theta = 1$	$\sin \theta = 1$

SESSION 5 | TRIGONOMETRY

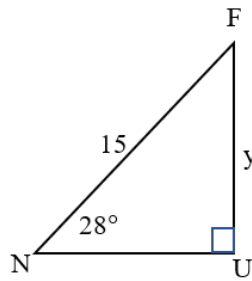
How to determine one of the unknown angles or side of a right-angled triangle.

Determine $\theta, \alpha, \beta, \omega, x, q$ and y in each of the following sketches.

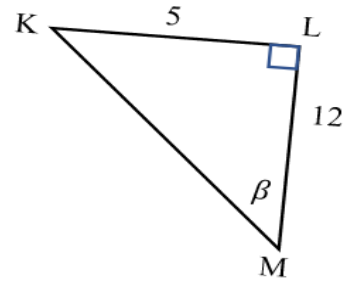
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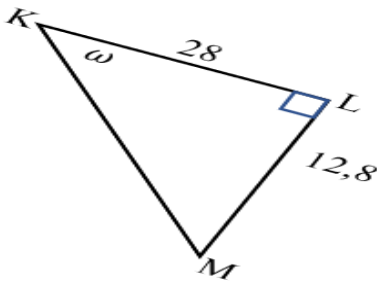
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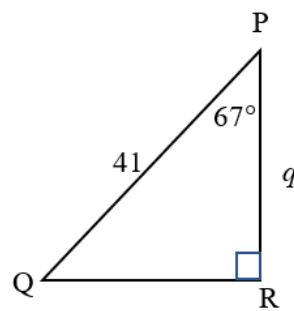
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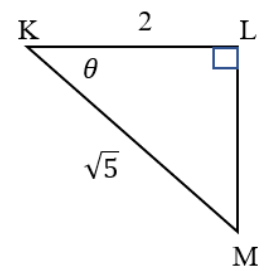
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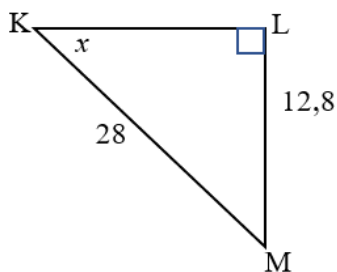
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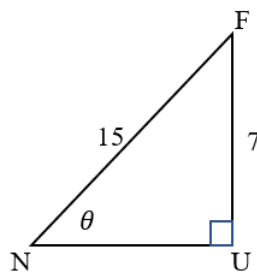
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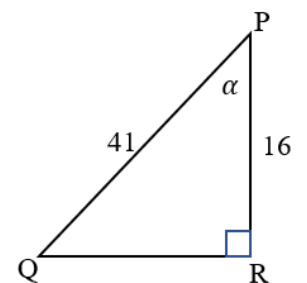
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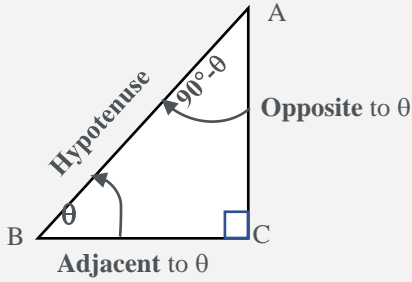


SESSION 5 | TRIGONOMETRY



CLASS DISCUSSIONS

TRIGONOMETRY: Ratios



$$\sin \theta = \frac{\text{opposite to } \theta}{\text{hypotenuse}}$$

$$\operatorname{cosec} \theta = \frac{\text{hypotenuse}}{\text{opposite to } \theta}$$

$$\cos \theta = \frac{\text{adjacent to } \theta}{\text{hypotenuse}}$$

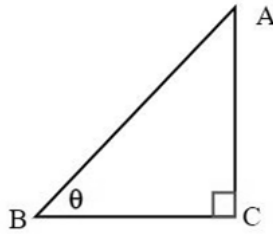
$$\sec \theta = \frac{\text{hypotenuse}}{\text{adjacent to } \theta}$$

$$\tan \theta = \frac{\text{opposite to } \theta}{\text{adjacent to } \theta}$$

$$\cot \theta = \frac{\text{adjacent to } \theta}{\text{opposite to } \theta}$$

Question 01

Write down the trigonometric ratios for $\sin \theta$, $\cos \theta$ and $\tan \theta$ by using the given sketch.

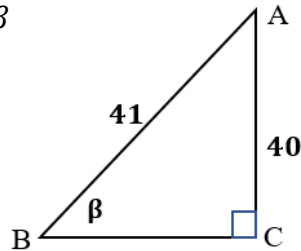


Answer 01

Question 02

Use $\triangle ABC$ below to determine the values of the following:

- 1) BC
- 2) $\tan \beta$
- 3) $\cos \beta$
- 4) $\sin(90^\circ - \beta)$
- 5) $\cos^2 \beta$



Answer 02

Question 03

A. Calculate the value of each of the following:

- 1) $\cos 35^\circ$
- 2) $\sin 68^\circ$
- 3) $5 \cos 60^\circ$
- 4) $\sin(35^\circ + 75^\circ)$

B. If $A = 23,8^\circ$ and $B = 18,1^\circ$

Calculate:

- 1) $\sin(A + B)$
- 2) $\tan 2B$
- 3) $\cos^2(2A - 10^\circ)$

Answer 03

SESSION 5 | TRIGONOMETRY



CLASS DISCUSSIONS

Calculator work

Solving Triangles

Question 04

Solve x correct to one decimal place in each of the following where $0^\circ \leq x \leq 90^\circ$:

a) $5 \cos x = 3$

b) $5 \cos 2x = 3$

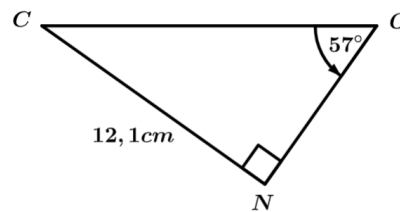
c) $5 \cos(x + 10^\circ) = 3$

d) $\frac{5 \cos x}{2} = 3$

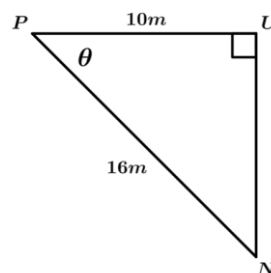
Answer 04

Question 05

Calculate the length of ON.



Calculate the size of θ .

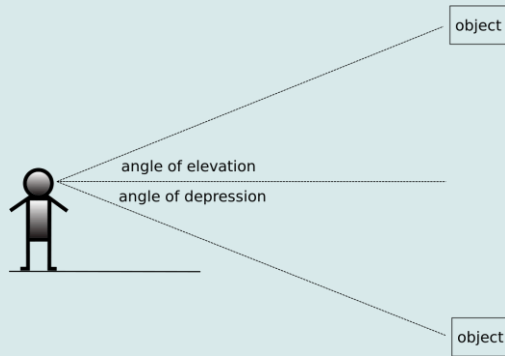


Answer 05

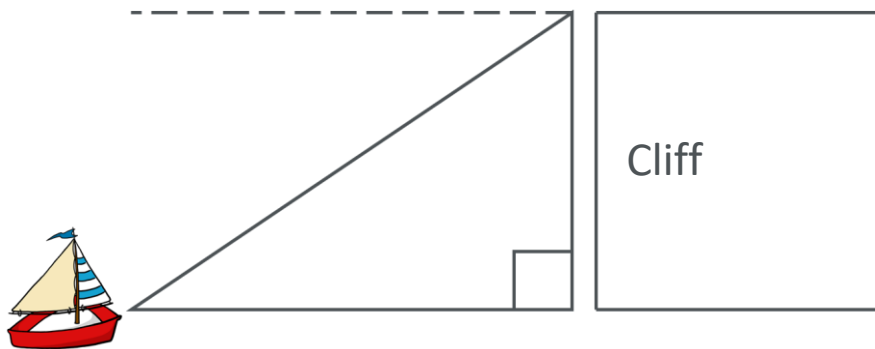
SESSION 7 | TRIGONOMETRY SOLVING TRIANGLES IN TWO DIMENSIONS

Term
Explanation

Angle of elevation
Angle of depression


Question 01

The angle of depression from the top of a cliff is 55° . The boat is 70m from the foot of the cliff.



- What is the angle of elevation from the boat to the top of the cliff?
- Calculate the height of the cliff.

Answer 01

SESSION 7 | TRIGONOMETRY SOLVING TRIANGLES IN TWO DIMENSIONS



CLASS DISCUSSIONS

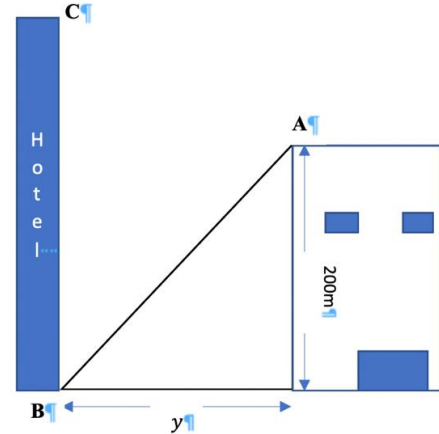
Angle of elevation and depression

Steps:

1. Read the question carefully.
2. Indicate all given information on the sketch.
3. Add implied information.
4. Determine information required to determine the unknown.
5. Identify the trigonometric ratio to use.

Question 01

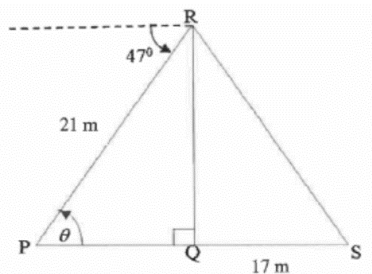
The angle of depression is 57° from point A on the top of a building 200m high to the base of a Hotel, B. Determine the distance on the ground between the building and the hotel.



Question 02

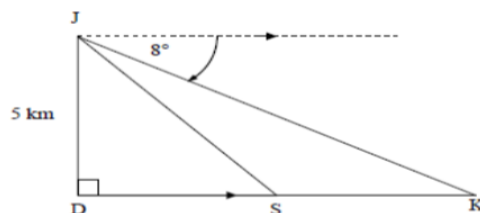
RQ is a vertical pole. The foot of the pole, Q, is on the same horizontal plane as P and S. The pole is anchored with cables RS and RP. The angle of depression from the top of the pole to the point P is 47° . PR is 21m and QS is 17m. $\widehat{P\hat{R}Q} = \theta$.

- a) Write down the size of θ .
- b) Calculate the length of RQ.
- c) Hence, calculate the size of \hat{S} .
- d) If P, Q and S lie in a straight line, how far apart are the anchors of the wire cables?



Question 03

An aeroplane at J is flying directly over a point D on the ground at a height of 5 kilometres. It is heading to land at point K. The angle of depression from J to K is 8° . S is a point along the route from D to K.



- a) Write down the size of \widehat{JKD} .
- b) Calculate the distance DK, correct to the nearest metre.
- c) If the distance SK is 8 kilometres, calculate the distance DS.
- d) Calculate the angle of elevation from the point S to J, correct to ONE decimal place.

SESSION 9 | TRIGONOMETRY CARTESIAN PLANE (0° ; 360°)

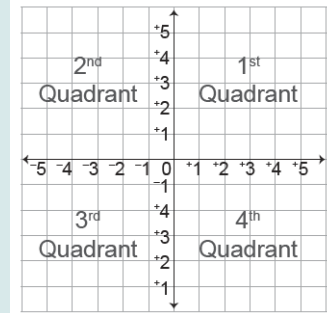
Term

Explanation

Quadrants

When a Cartesian plane is drawn with an x -axis and y -axis, then each of the four areas is a quadrant.

- The Cartesian plane is divided into 4 quadrants.
- We measure angles in an anti-clockwise way, starting with 0° on the positive horizontal axis.



Cartesian Plane

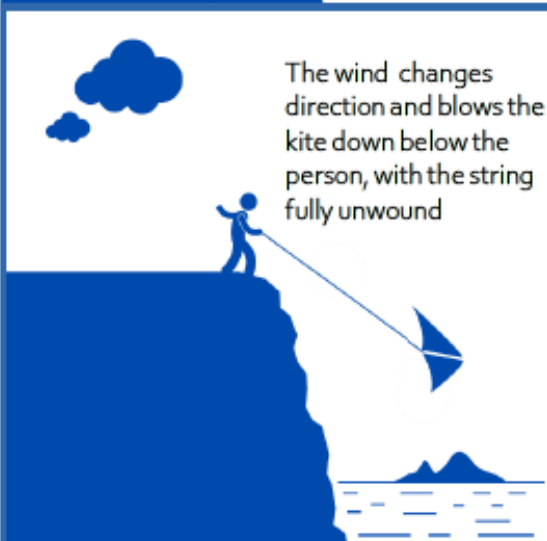
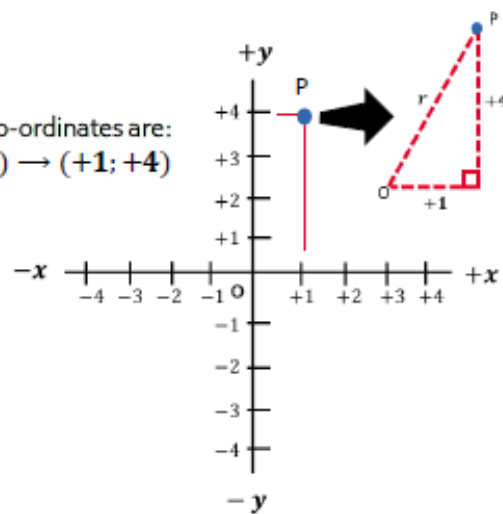
Using right-angled triangles, we were able to define the trigonometric ratios. These trigonometric ratios can be extended to any angle within a Cartesian plane, by forming a right angle triangle for any given point. This allows us to work with angles beyond 90° , beyond the geometric (right angle) definition.

Cartesian Positions

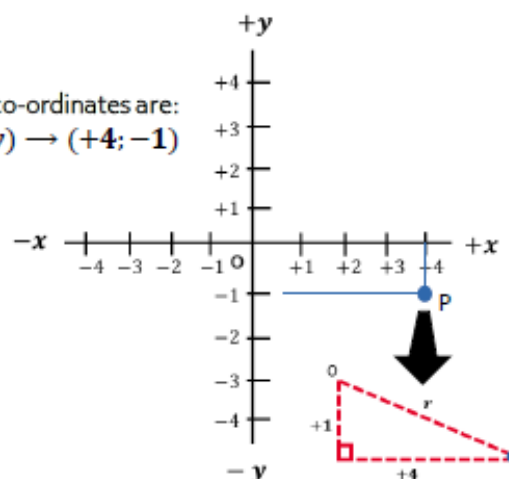
What is the position of the kite relative to the person?



The co-ordinates are:
 $(x; y) \rightarrow (+1; +4)$



The co-ordinates are:
 $(x; y) \rightarrow (+4; -1)$



SESSION 9: TRIGONOMETRY CARTESIAN PLANE (0° ; 360°)

Angles in the Cartesian Plane

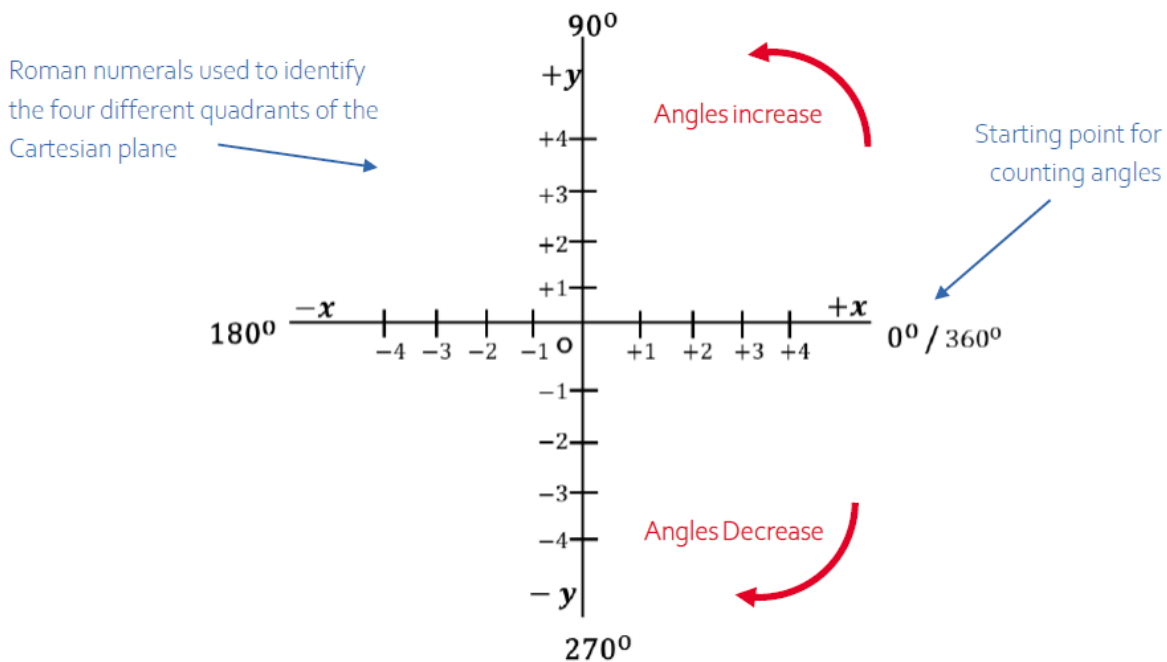
If you move 360° , either clockwise or anti-clockwise, in the Cartesian plane you will complete a full circle.

Starting on the right-hand side of the x -axis, the angles increase anti-clockwise, starting from 0° . A full 360° rotation returns you to the same starting point, in this case 0° .

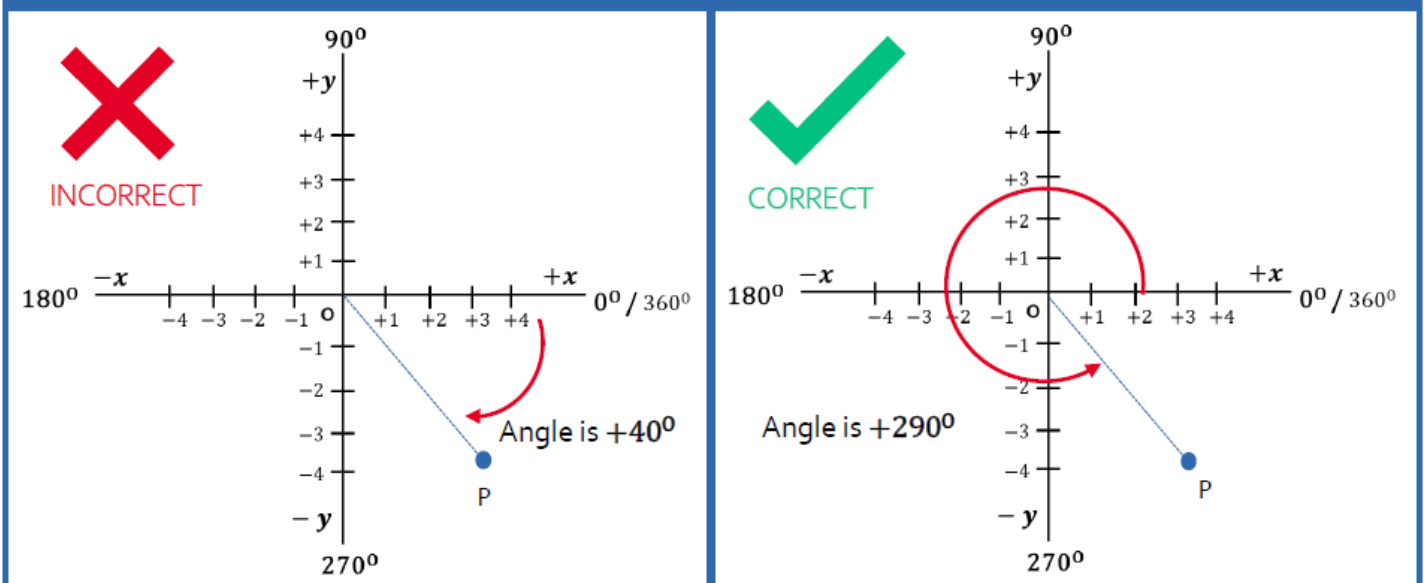
It is NOT a clock!

Angles INCREASE in the ANTI-CLOCKWISE DIRECTION

Angles DECREASE in the CLOCKWISE DIRECTION



How to read the angle of point P on a Cartesian plane

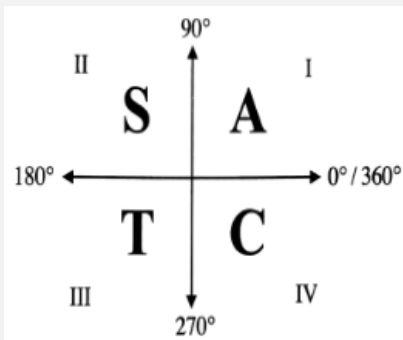


SESSION 9 | TRIGONOMETRY CARTESIAN PLANE



CLASS DISCUSSIONS

CAST-Diagram



Question 01

1. In which quadrant is each of the following angles?

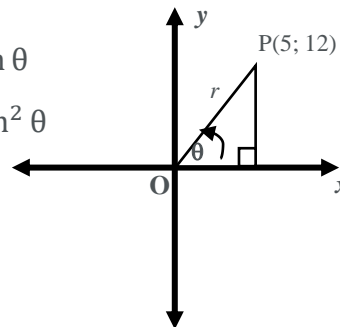
- 1) 39°
- 2) 132°
- 3) 346°
- 4) 101°
- 5) 271°
- 6) 89°

Answer 01

Question 02

Use the diagram to determine the value of:

- (a) r
- (b) $\sin \theta$
- (c) $\tan^2 \theta$

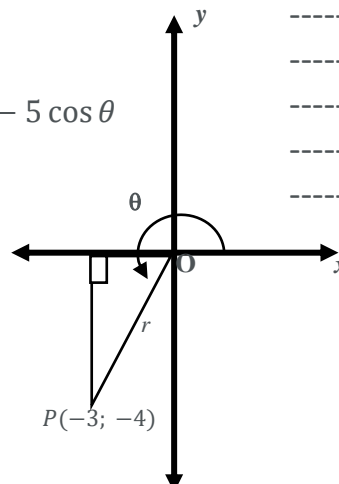


Answer 02

Question 03

Use the diagram to determine the value of:

- (a) r
- (b) $25\sin^2 \theta - 5 \cos \theta$



Answer 03

SESSION 9 | TRIGONOMETRY CARTESIAN PLANE



CLASS DISCUSSIONS

CAST-Diagram

Steps:

1. Write in most simplified form:
trig ratio (angle) = number
2. Determine the quadrant
3. Draw a sketch
4. Calculate the missing side
5. Answer the questions

Question 04

If $5\sin \theta - 4 = 0$ and $\theta \in [90^\circ; 270^\circ]$, determine, without using a calculator, the value of $\cos^2 \theta$.

Answer 04

Question 05

If $41 \cos \theta + 9 = 0$ and $180^\circ < \theta < 360^\circ$, determine, without the use of a calculator the value of:

$$9 \tan \theta + 41 \sin \theta$$

Answer 05

Question 06

Given that $4 \cot \theta + 3 = 0$ and $0^\circ < \theta < 180^\circ$

Use a sketch to determine the value of:

- a) $\cos \theta$
- b) $\frac{3 \sin \theta \sec \theta}{\tan \theta}$

Answer 06

SESSION 9 | TRIGONOMETRIE (CAST-Diagram)

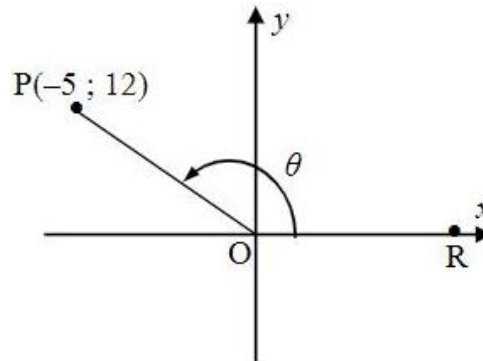


WORSHEET

CAST-Diagram

Question 01

In the diagram is $P(-5; 12)$ a point in the Cartesian plane and $\widehat{R\hat{O}P} = \theta$

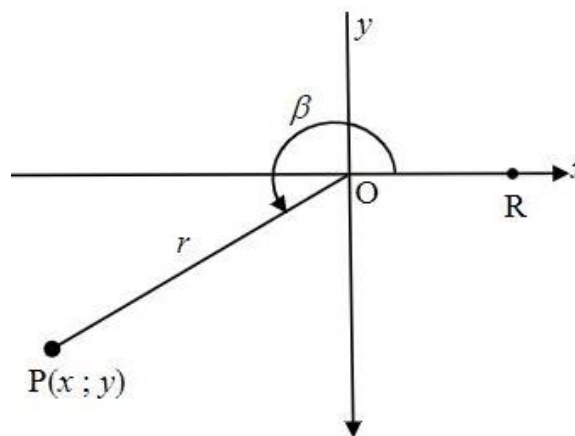


Determine the value of:

- 1) $\cos \theta$
- 2) $\operatorname{cosec}^2 \theta + 1$

Question 02

In the diagram below is $P(x; y)$ a point in the third quadrant. $\widehat{R\hat{O}P} = \beta$ and $17 \cos \beta + 15 = 0$.



- 1) Write down the values of x , y and r .
- 2) Without a calculator determine the value of:
 - a) $\sin \beta$
 - b) $\cos^2 30^\circ \cdot \tan \beta$
- 3) Determine the size of $\widehat{R\hat{O}P}$ correct to TWO decimal places.

SESSION 11:

MATHEMATICS PAPER 1

Mathematics/P1

2
CAPS – Grade 10

DBE/November 2018

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of EIGHT questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, etc. that you have used in determining your 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 answers off to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. Number the answers correctly according to the numbering system used in this question paper.
9. Write neatly and legibly.

SESSION 11: MATHEMATICS PAPER 1

QUESTION 1

1.1 Factorise the following expressions fully:

1.1.1 $4x - x^3$ (2)

1.1.2 $x^2 + 15x - 54$ (2)

1.1.3 $y - xy + x - 1$ (3)

1.2 Simplify the following expressions fully:

1.2.1 $(x+2)(x^2 - x + 3)$ (2)

1.2.2 $\frac{5}{x+3} - \frac{3}{2-x}$ (3)

1.2.3 $\frac{25^{-x} \cdot 15^{x+1}}{3^x \cdot 5^{-x}}$ (3)

1.3 Determine the value of $(3p+q)^2$ if $9p^2 + q^2 = 12$ and $pq = -3$. (3)
[18]

QUESTION 2

2.1 Solve for x :

2.1.1 $px + qx = a$ (2)

2.1.2 $2x^2 - 5x + 2 = 0$ (3)

2.1.3 $\left(\frac{1}{2}\right)^{3x+1} = 32$ (3)

2.2 Given: $-11 \leq 3m - 8 < 4$

2.2.1 Solve for m . (2)

2.2.2 Hence, write down the number of integers that satisfy the inequality. (1)

2.3 Solve simultaneously for x and y if:

$5x + 4y = 21$ and $2x = 3 - y$ (4)

MATHEMATICS PAPER 1

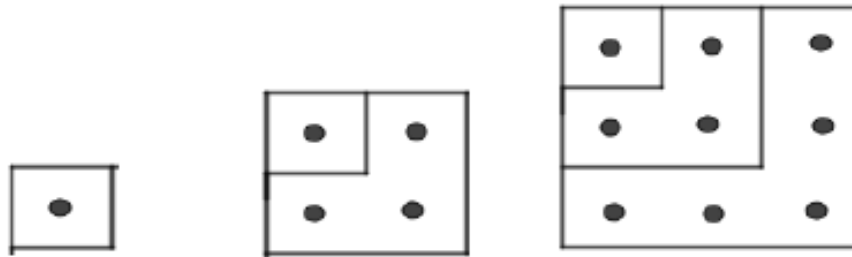
QUESTION 3

Consider the finite linear pattern: 20 ; 17 ; 14 ; ... ; -103

- 3.1 Write down the 4th term of the pattern. (1)
- 3.2 Determine the expression for the n^{th} term. (2)
- 3.3 Calculate the number of terms in the sequence. (2)
- 3.4 Which term is the first to have a negative value? (3)
- 3.5 What is the value of the 19th even-valued term in the sequence? (2)
- [10]**

QUESTION 4

Samantha is investigating a pattern of dots represented in the diagram below.



Pattern number:	1	2	3
Number of dots:	$1^2 = 1$	$1 + 3 = 2^2 = 4$	$1 + 3 + 5 = 3^2 = 9$

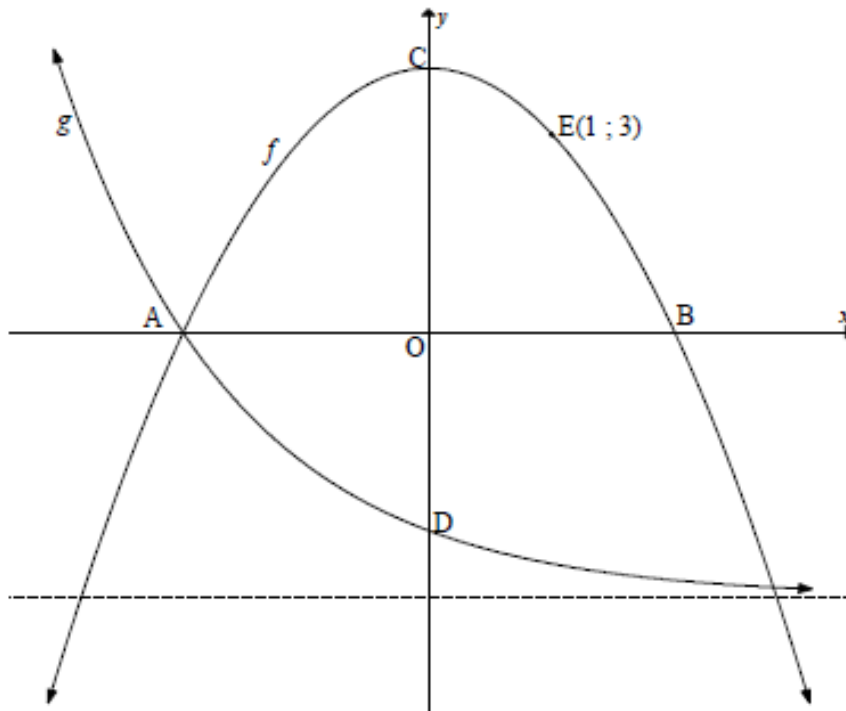
- 4.1 Write down:
- 4.1.1 The number of dots in the 4th pattern (1)
- 4.1.2 The number of dots in the 13th pattern (1)
- 4.1.3 A formula for the number of dots in the n^{th} pattern (1)
- 4.2 Hence, or otherwise, calculate the value of:
- $$1 + 3 + 5 + \dots + 43$$
- (3)**
[6]

MATHEMATICS PAPER 1

QUESTION 5

Sketched below are the graphs of $f(x) = ax^2 + q$ and $g(x) = \left(\frac{1}{2}\right)^x - 4$.

A and B are the x -intercepts of f . The graphs intersect at A and point E (1 ; 3) lies on f .
C is the turning point of f and D is the y -intercept of g .



- 5.1 Write down the:
- 5.1.1 Coordinates of D (2)
 - 5.1.2 Range of g (1)
- 5.2 Calculate the:
- 5.2.1 Coordinates of A (2)
 - 5.2.2 Values of a and q (4)
- 5.3 Determine the:
- 5.3.1 Length of CD (2)
 - 5.3.2 Equation of a straight line through A and D (3)
- 5.4 For which values of x is:
- 5.4.1 $f(x) > 0$? (2)
 - 5.4.2 f decreasing? (1)
- [17]**

MATHEMATICS PAPER 1

QUESTION 6

The equation of the function $g(x) = \frac{a}{x} + q$ passes through the point $(3; 2)$ and has a range of $y \in (-\infty; 1) \cup (1; \infty)$.

- 6.1 Determine the:
- 6.1.1 Equation of g (3)
- 6.1.2 Equation of h , the axis of symmetry of g which has a positive gradient (2)
- 6.2 Sketch the graphs of g and h on the same system of axes. Clearly show ALL the asymptotes and intercepts with axes. (4)
- 6.3 Write the equations of the asymptotes of f if $f(x) = -g(x) + 5$. (3)
- [12]

QUESTION 7

Read the advertisement below.

**Buy a Samsung J5 for only
R229 per month.**

**You have 24 months to pay.
No deposit is required.**

- 7.1 Calculate the total amount to be paid over a period of 24 months. (1)
- 7.2 The monthly instalment, quoted in the advertisement, is calculated on a hire purchase agreement which charges interest of 7,5% p.a. on the cash price of the cellphone. Show that the price of the cellphone is R4 779,13. (2)
- 7.3 Calculate the total interest paid over a period of 24 months if the cellphone is bought with this hire purchase agreement. (1)
- 7.4 The cellphone is insured at 11,5% p.a. of the cash price. The total insurance is calculated and then split up over 24 months. It is then added to the monthly instalment. Calculate the new monthly instalment if the customer wants to insure the cellphone. (3)
- 7.5 The cost of the cellphone is subject to inflation and increases to a cash price of R5 100,00 after 2 years. Calculate the annual inflation rate. (4)
- [11]

MATHEMATICS PAPER 1

QUESTION 8

8.1 In a random physical sciences experiment, A and B are two different events. It was found that:

$$P(A) = \frac{2}{5}, P(B') = \frac{3}{8} \text{ and } P(A \text{ or } B) = \frac{5}{7}$$

8.1.1 Calculate:

(a) $P(B)$ (2)

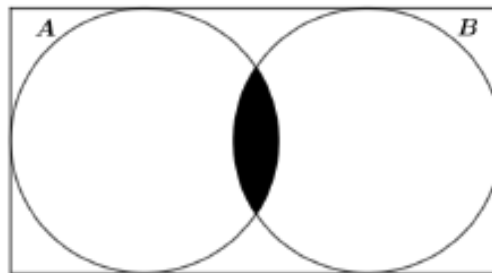
(b) $P(A \text{ and } B)$ (3)

8.1.2 Hence, determine whether events A and B are mutually exclusive. Motivate your answer. (2)

8.2 The Venn diagrams below represent different scenarios of events A and B.

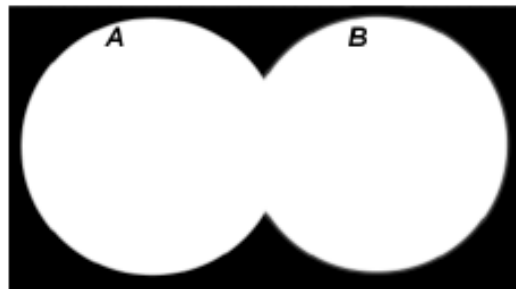
Write down the probability of the shaded region for EACH of the diagrams below.

8.2.1



(1)

8.2.2



(1)

8.2.3



(1)

8.3 Which diagram(s) in QUESTIONS 8.2.1, 8.2.2 or 8.2.3 represent mutually exclusive events? (1)
[11]

TOTAL: 100

SESSION 13:

MATHEMATICS PAPER 2

Mathematics/P2

2
CAPS – Grade 10

DBE/November 2018

INSTRUCTIONS AND INFORMATION

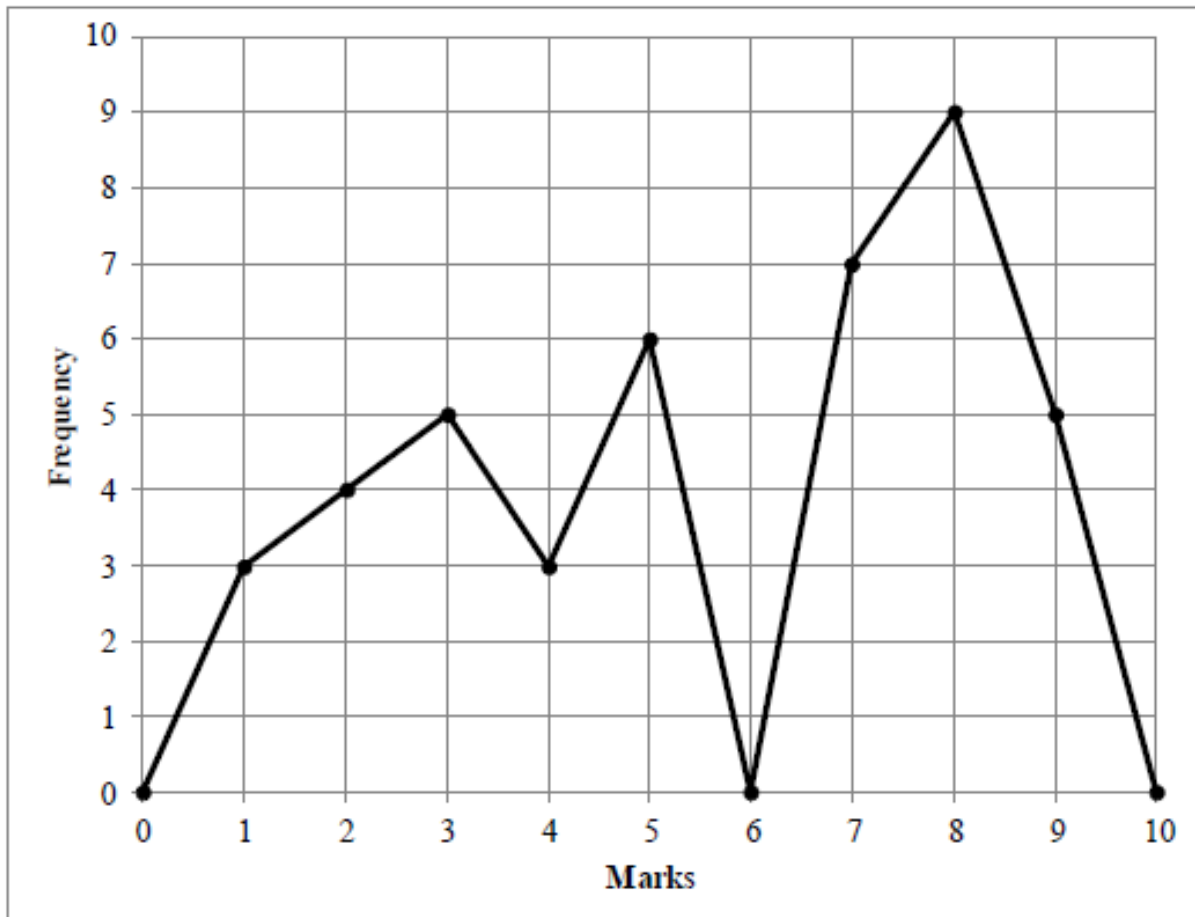
Read the following instructions carefully before answering the questions.

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

SESSION 13: MATHEMATICS PAPER 2

QUESTION 1

The line graph below shows test marks out of 10 obtained by a Grade 10 class.

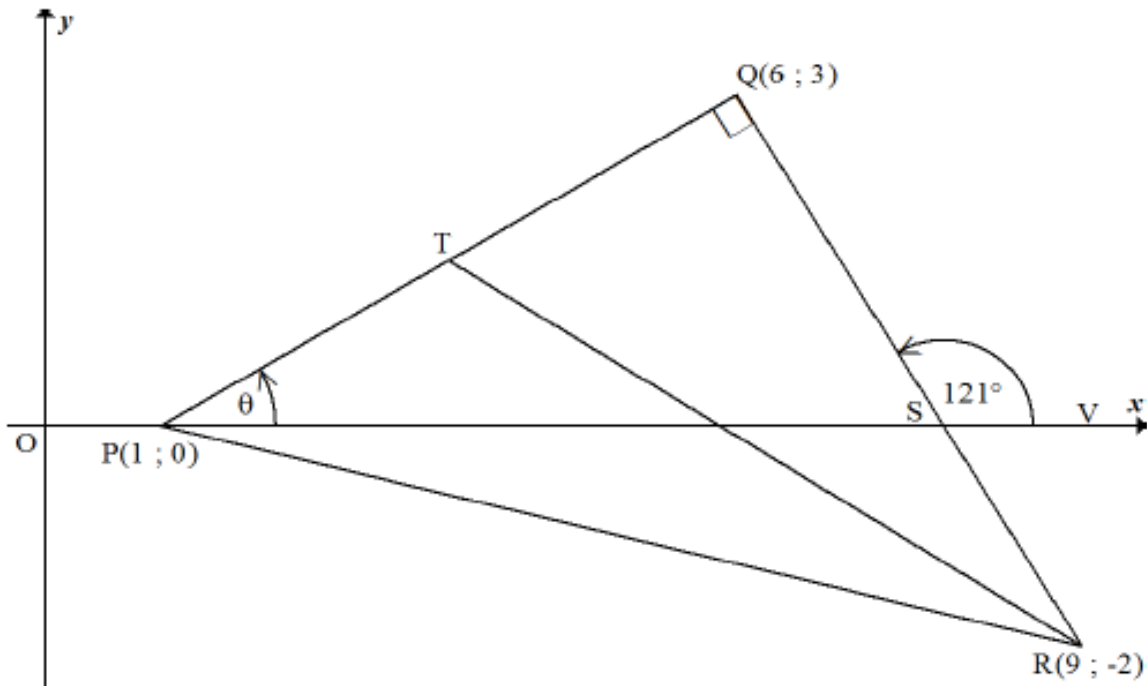


- 1.1 Complete the frequency column in the table provided in the ANSWER BOOK. (2)
- 1.2 How many learners wrote the test? (1)
- 1.3 Calculate the:
- 1.3.1 Range for the data (2)
- 1.3.2 Mean for the test (3)
- 1.4 Determine the median for the data. (3)
- 1.5 Draw a box and whisker diagram for the data. (3)
- [14]

SESSION 13: MATHEMATICS PAPER 2

QUESTION 2

In the diagram below, $P(1 ; 0)$, $Q(6 ; 3)$ and $R(9 ; -2)$ are the vertices of a triangle such that $PQ = QR$ and $PQ \perp QR$. T is a point on PQ such that T is the midpoint of PQ . S is the point of intersection of RQ and the x -axis. V is a point on the x -axis such that $\widehat{QSV} = 121^\circ$. $\widehat{QPS} = \theta$

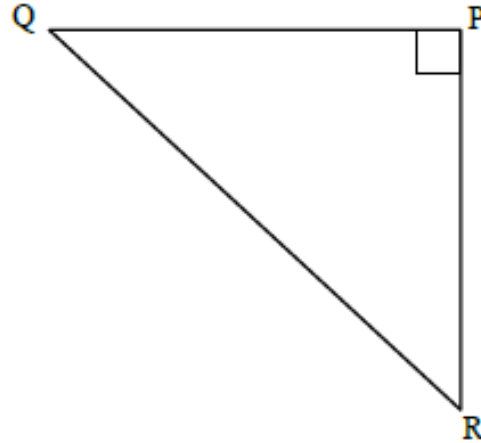


- 2.1 Determine the:
- 2.1.1 Length of PQ . Leave your answer in surd form. (2)
 - 2.1.2 Gradient of PQ (2)
 - 2.1.3 Coordinates of T (2)
- 2.2 Calculate the:
- 2.2.1 Area of $\triangle QTR$ (3)
 - 2.2.2 Size of θ , with reasons (2)
 - 2.2.3 Coordinates of S (3)
- 2.3 Determine, with reasons, the gradient of the line through T and the midpoint of PR . (3)
- [17]

SESSION 13: MATHEMATICS PAPER 2

QUESTION 3

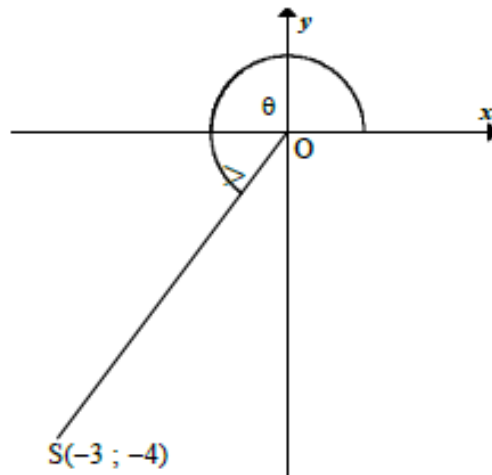
3.1 In the diagram below, $\triangle QPR$ is a right-angled triangle with $\hat{Q}PR = 90^\circ$.



3.1.1 Use the sketch to determine the ratio of $\tan(90^\circ - R)$. (1)

3.1.2 Write down the trigonometric ratio that is equal to $\frac{QR}{QP}$. (1)

3.2 $S(-3; -4)$ is a point on the Cartesian plane such that OS makes an angle of θ with the positive x -axis.



Calculate the following WITHOUT using a calculator:

3.2.1 The length of OS (2)

3.2.2 The value of $\sec \theta + \sin^2 \theta$ (3)

3.3 Determine the value of the following WITHOUT using a calculator:

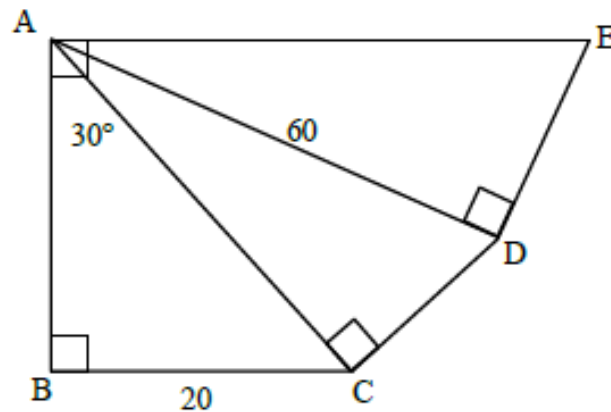
$$\frac{\operatorname{cosec} 45^\circ}{\sin 90^\circ \cdot \tan 60^\circ} \quad (4)$$

[11]

SESSION 13: MATHEMATICS PAPER 2

QUESTION 4

- 4.1 In the diagram below, ABC , ACD and ADE are right-angled triangles. $\hat{BAE} = 90^\circ$ and $\hat{BAC} = 30^\circ$. $BC = 20$ units and $AD = 60$ units.



Calculate the:

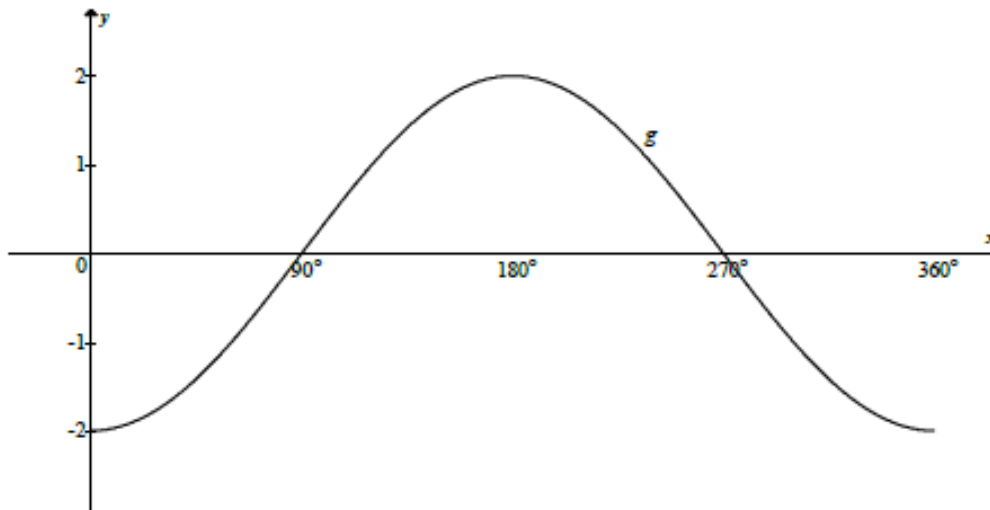
- 4.1.1 Length of AC (2)
- 4.1.2 Size of \hat{CAD} (2)
- 4.1.3 Length of DE (3)
- 4.2 Solve for x , correct to ONE decimal place, where $0^\circ \leq x \leq 90^\circ$:
- 4.2.1 $\tan x = 2,01$ (2)
- 4.2.2 $5 \cos x + 2 = 4$ (3)
- 4.2.3 $\frac{\operatorname{cosec} x}{2} = 3$ (3)
- [15]

QUESTION 5

- 5.1 Consider the function $f(x) = -3 \tan x$.
- 5.1.1 Sketch, on the grid provided in the ANSWER BOOK, the graph of f for $0^\circ \leq x \leq 360^\circ$. Clearly show ALL the intercepts and asymptotes. (3)
- 5.1.2 Hence, or otherwise, write down the:
- (a) Period of f (1)
- (b) Equation of h if h is the reflection of f about the x -axis (1)

SESSION 13: MATHEMATICS PAPER 2

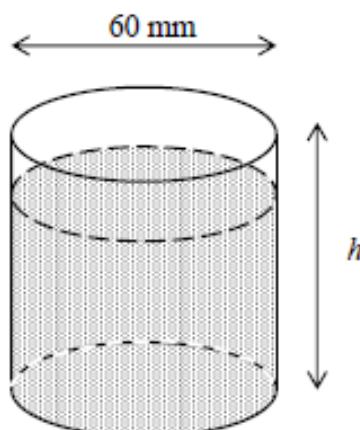
5.2 Sketched below is the graph of $g(x) = a \cdot \cos b\theta$



- 5.2.1 Write down the values of a and b . (2)
- 5.2.2 Use the graph to determine the value(s) of x for which $g(x) > 0$. (1)
- 5.2.3 Determine the range of h if h is the image of g if g is shifted down TWO units. (2)
- 5.2.4 Determine, using the graph, the value of:
 $-2(\cos 0^\circ + \cos 1^\circ + \cos 2^\circ + \dots + \cos 358^\circ + \cos 359^\circ + \cos 360^\circ)$ (2)
 [12]

QUESTION 6

The diagram below shows a cup with a volume of $117\pi \text{ cm}^3$ and an inner diameter of 60 mm. Ignore the thickness of the cup.



Calculate the:

- 6.1 Height of the cup (3)
- 6.2 Total surface area of the water that touches the cup if the cup is 80% full with water (4)
 [7]

SESSION 13: MATHEMATICS PAPER 2

Give reasons for ALL geometry statements in QUESTIONS 7 and 8.

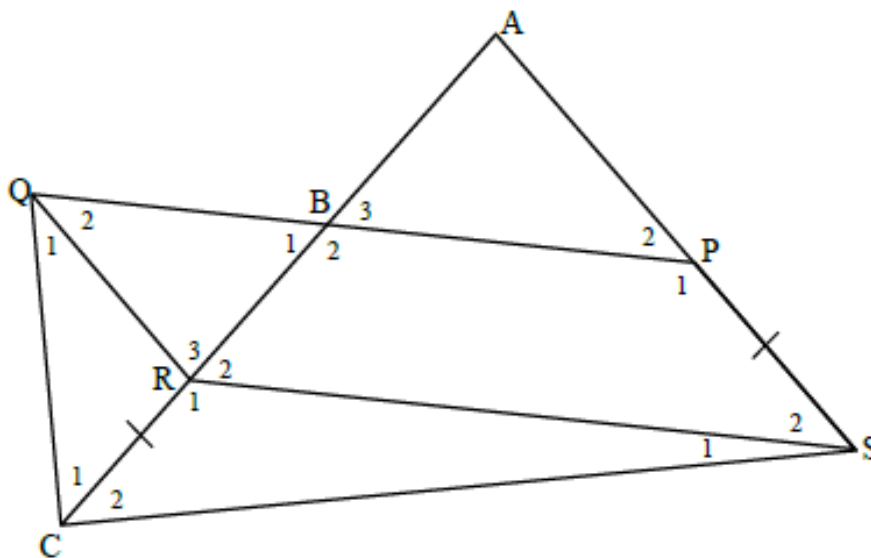
QUESTION 7

7.1 Complete the statement so that it is TRUE:

The line drawn from the midpoint of the one side of a triangle, parallel to the second side, ...

(1)

7.2 ACS is a triangle. P is a point on AS and R is a point on AC such that PSRQ is a parallelogram. PQ intersects AC at B such that B is the midpoint of AR. QC is joined. Also, $CR = PS$, $\hat{C}_1 = 50^\circ$ and $BP = 60$ mm.



7.2.1 Calculate the size of \hat{A} .

(5)

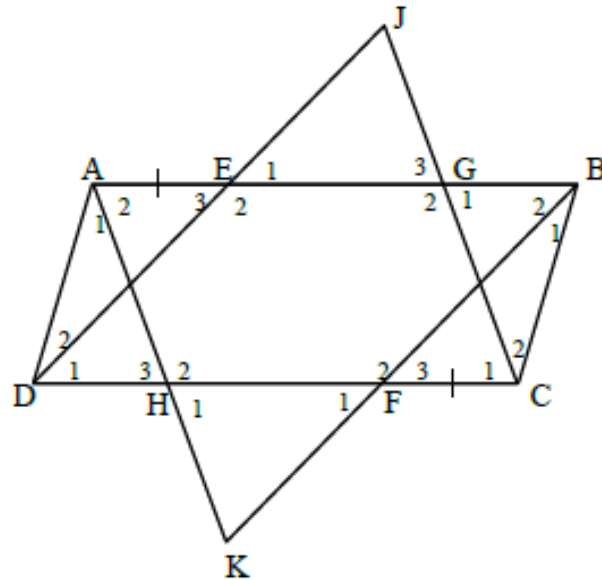
7.2.2 Determine the length of QP.

(3)

[9]

SESSION 13: MATHEMATICS PAPER 2
QUESTION 8

- 8.1 ABCD is a parallelogram. E and F are points on AB and DC respectively such that $AE = CF$. DE is produced to J and CJ is drawn. BF is produced to K and AK is drawn.

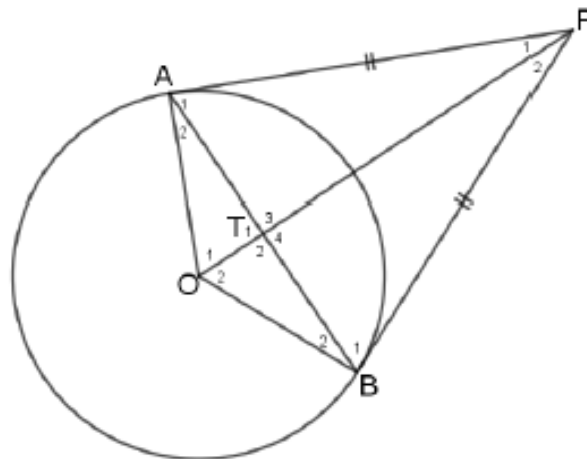


Prove that:

8.1.1 $DJ \parallel BK$ (5)

8.1.2 $\hat{E}_1 = \hat{F}_1$ (4)

- 8.2 In the diagram below O is the centre of the circle. A and B lie on the circumference of the circle. $AP = BP$.



Prove that:

8.2.1 $AT = BT$ (5)

8.2.2 $\hat{O}TA = 90^\circ$ (1)
[15]

TOTAL: 100