



# basic education

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Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 11**

**TECHNICAL MATHEMATICS**

**EXEMPLAR 2017**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 9 pages and 1 answer sheet.**

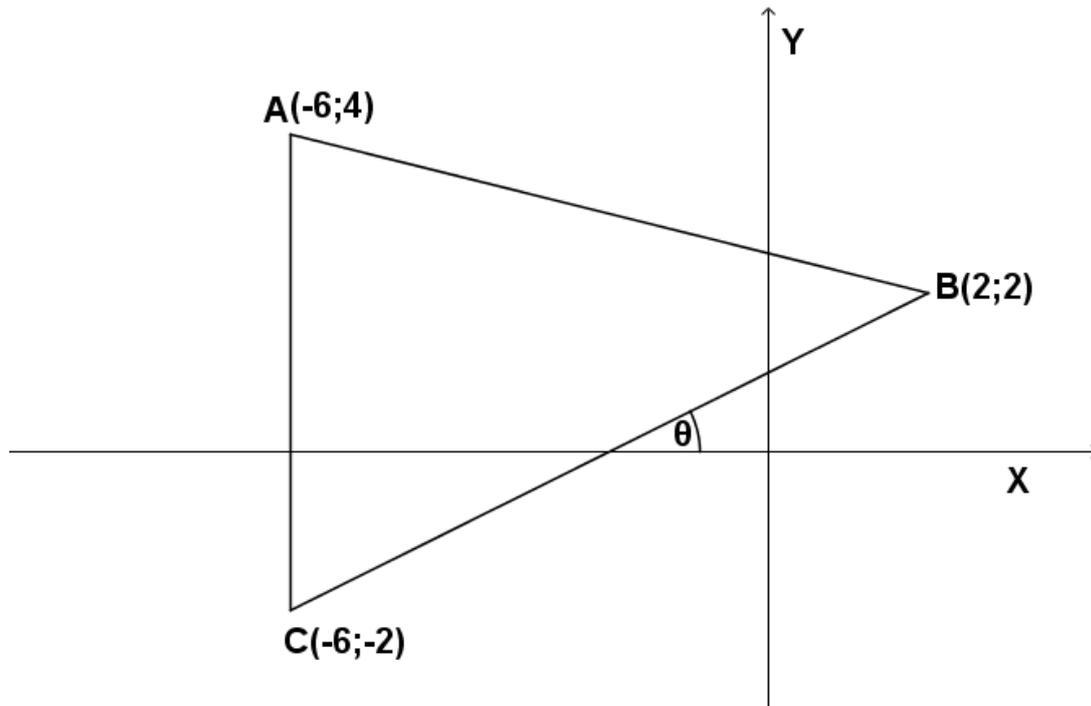
**INSTRUCTIONS AND INFORMATION**

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 etcetera 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. An ANSWER SHEET for answering QUESTION 4.1 is given at the end of the question paper. Detach and place it in your ANSWER BOOK.
8. You may use an approved scientific calculator (non-programmable and non-graphical)
9. Write neatly and legibly.

**QUESTION 1**

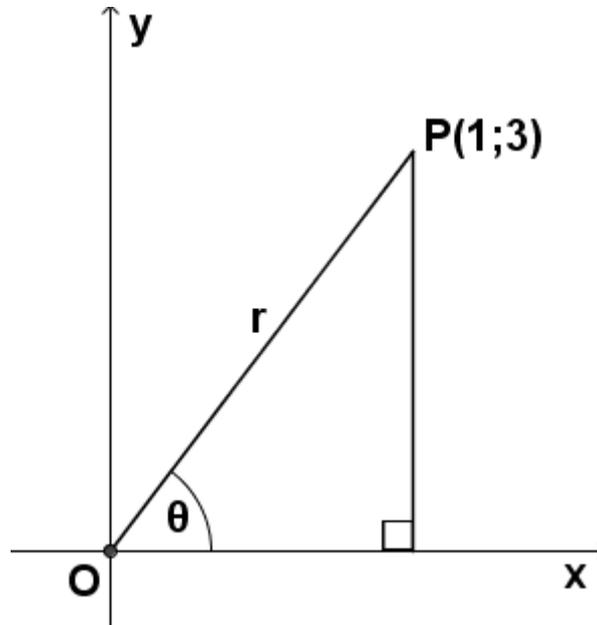
In the diagram below  $\triangle ABC$  has vertices  $A(-6 ; 4)$ ,  $B(2 ; 2)$  and  $C(-6 ; -2)$  in the Cartesian plane. The angle of inclination of  $BC$  is  $\theta$ .



- 1.1 Determine the gradient of  $AB$ . (3)
  - 1.2 Determine the co-ordinates of  $D$  the midpoint of  $AC$ . (3)
  - 1.3 Determine the equation of straight line  $BD$  in the form  $y = mx + c$ . (4)
  - 1.4 Determine the distance between points  $B$  and  $C$ . (3)
  - 1.5 Determine the size of  $\theta$ . (3)
  - 1.6 Hence calculate the size of  $\hat{C}$ . (4)
  - 1.7 Determine the equation of the straight line which passes through point  $D$  and is parallel to  $AB$ . (4)
- [24]**

**QUESTION 2**

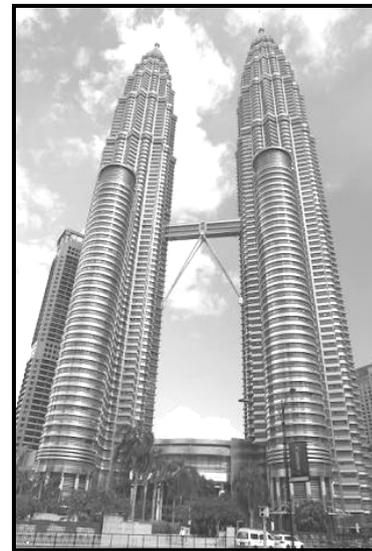
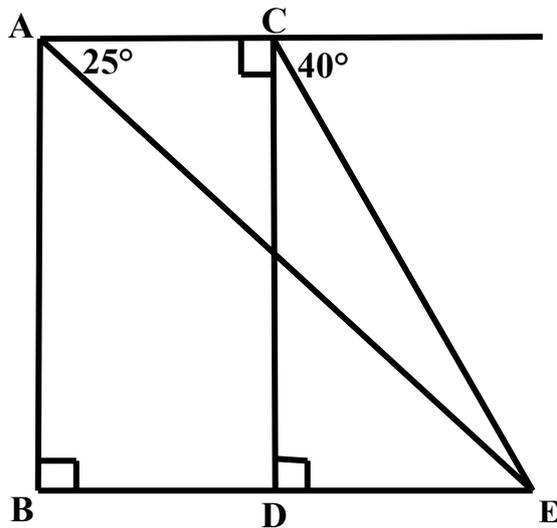
2.1 In the diagram below, P (1 ; 3) is a point on the Cartesian plane,  $OP = r$  and  $\widehat{XOP} = \theta$ .



- 2.1      2.1.1      Use the diagram to calculate the value of  $\theta$ . (2)
- 2.1.2      Calculate the length of OP. Leave the answer in surd form. (2)
- 2.1.3      Determine the values of the following WITHOUT USING A CALCULATOR:
- (a)  $\sin \theta$  (1)
- (b)  $\cos (180 + \theta)$  (2)
- 2.2      Determine the value(s) of  $x$  for  $x \in [0^{\circ}; 360^{\circ}]$ , for which  $\tan(\theta - 60^{\circ}) = 4$ . (3)
- 2.3      Simplify:  $\frac{\cos(360^{\circ} - x) \cdot \sin(180^{\circ} - x) \cdot \tan 135^{\circ}}{\cos^2(180^{\circ} + x) \cdot \sin 240^{\circ}}$  (7)
- 2.4      Prove that:  $\frac{\sin x}{1 + \cos x} + \frac{1 + \cos x}{\sin x} = \frac{2}{\sin x}$  (5)
- [22]**

**QUESTION 3**

Two towers, AB and CD, are built by a newly formed municipality. BDE is a horizontal line. The angle of depression from A to E is  $25^\circ$  and the angle of depression from C to E is  $40^\circ$ .



- 3.1 Write down the size of  $\widehat{DEC}$ . (1)
  - 3.2 Determine the length of CD (the height of the towers) if  $DE = 100$  m. (3)
  - 3.3 Determine the size of  $\widehat{AEC}$ . (2)
  - 3.4 Determine the length of CE. (2)
  - 3.5 How far are the towers from each other? (Length of AC or BD.) (5)
- [13]**

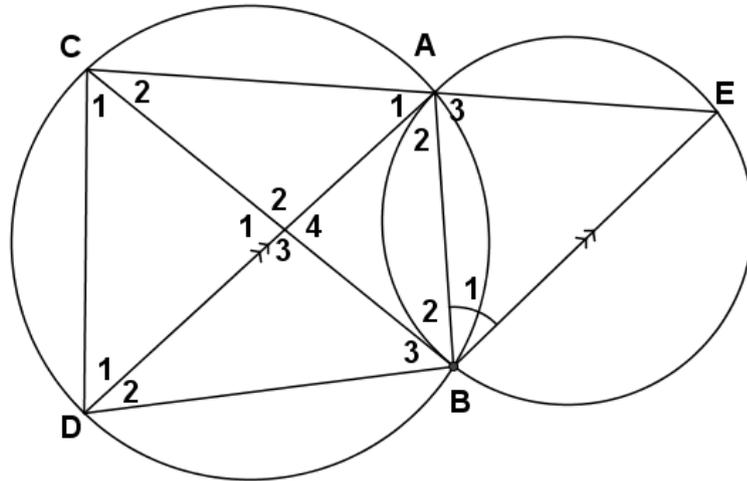
**QUESTION 4**

Given:  $f(x) = 2 \cos x$  and  $g(x) = \sin(x + 30^\circ)$

- 4.1 Draw the graph of  $f$  and  $g$  on the same set of axes on the attached ANSWER SHEET for  $x \in [0^\circ; 360^\circ]$ . (5)
  - 4.2 Write down the amplitude of  $f$ . (1)
  - 4.3 Write down the period of  $g$ . (1)
  - 4.4 Use your graph to determine the values of  $x$  for which the graph of  $g$  is strictly increasing for  $x \in [0^\circ; 360^\circ]$ . (2)
  - 4.5 For which value(s) of  $x$  is  $f(x) < g(x)$  where  $x \in [0^\circ; 270^\circ]$ ? (2)
- [11]**

**QUESTION 5**

In the diagram below two circles intersect at A and B. BE is a tangent to the bigger circle at B and a chord of the smaller circle. DA || BE and DA bisect  $\hat{CAB}$ .  $\hat{ABE} = 40^\circ$ .

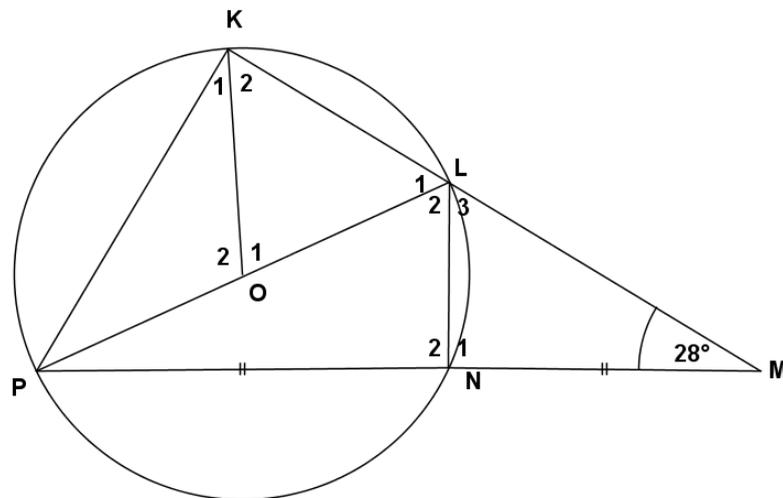


5.1 Name, with reasons, SEVEN other angles that are equal to  $\hat{ABE} = 40^\circ$ . (14)

5.2 Determine the size of angle  $\hat{A}_3$ . (2)  
[16]

**QUESTION 6**

In the diagram below PL is the diameter of the circle with centre O. Chord PN is produced to M such that PN = NM.  $\hat{PMK} = 28^\circ$ .



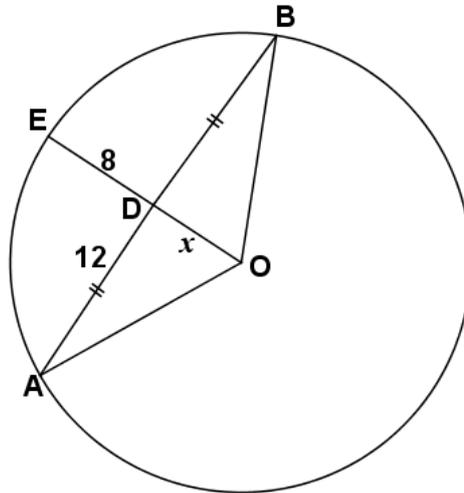
Calculate the sizes of:

6.1  $\hat{LPN}$  (6)

6.2  $\hat{KOP}$  (5)  
[11]

**QUESTION 7**

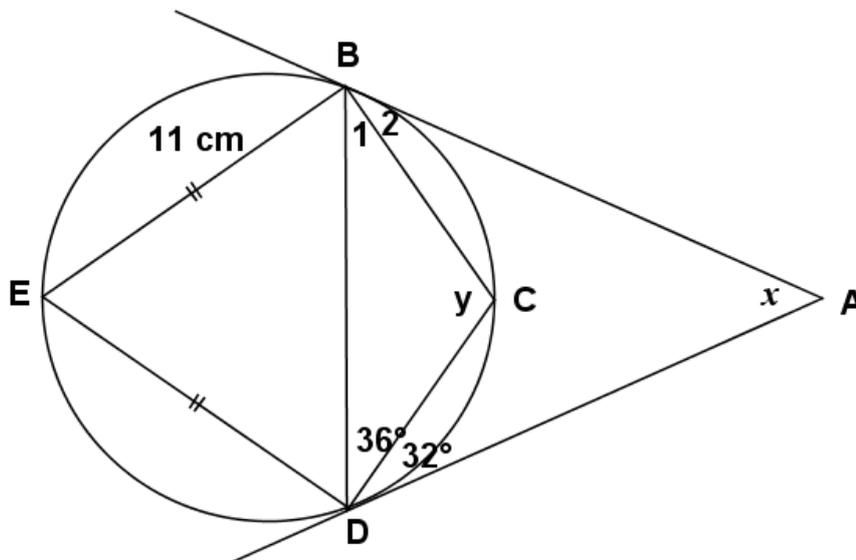
7.1 AB is a chord of a circle O. OE bisects AB.  
AD = 12, ED = 8 cm and OD =  $x$ .



7.1.1 Determine the radius OB in terms of  $x$ . (1)

7.1.2 Hence calculate the length of the radius OB. (4)

7.2 In the diagram below AB and AD are tangents to the circle at B and D respectively.  
EB = ED;  $\hat{BDC} = 36^\circ$ ;  $\hat{ADC} = 32^\circ$ ; BE = 11 cm.



7.2.1 Determine the value of  $x$ . (3)

7.2.2 Determine the value of  $y$ . (3)

7.3 Determine the length of BD correct to 2 decimal places. (4)

**[15]**

**QUESTION 8**

- 8.1 Determine the length of an arc that subtends a central angle of  $50^\circ$  in a circle with a diameter of 52 cm. (2)

- 8.2 A wind turbine is a turbine with a large bladed wheel rotated by the wind to generate electricity.  
The turbine rotates at 38 revolutions per minute.



- 8.2.1 Convert 38 revolutions per minute to revolutions per second. (1)  
8.2.2 Calculate the angular velocity. (3)

- 8.3 A train takes 40 minutes to cover two-thirds of a revolution on a circular track. The diameter of the track is 8 km.



Calculate:

- 8.3.1 The peripheral velocity of a train in kilometres per hour (4)  
8.3.2 The time it takes to complete 4 revolutions (2)  
**[12]**

**QUESTION 9**

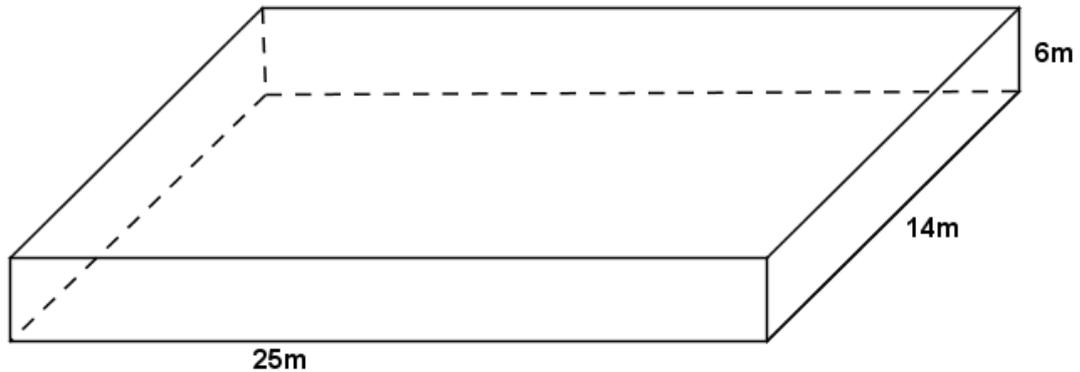
- 9.1 The arc length of a sector is 2,1 m and it subtends an angle of 1,8 radians.

Calculate:

- 9.1.1 The radius of a circle in cm (2)  
9.1.2 The area of the sector (3)  
9.2 A chord with a length of 200 mm divides a circle of diameter 36 cm into two segments. Calculate the heights of the segments. (5)  
**[10]**

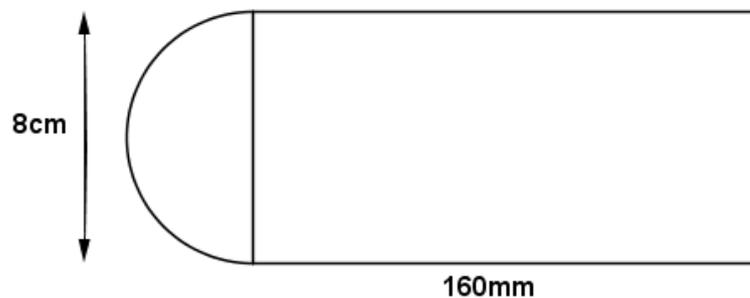
**QUESTION 10**

- 10.1 The inside of a pool is in the shape of a rectangular prism. The pool is 25 m long; 14 m wide and 6 m deep.

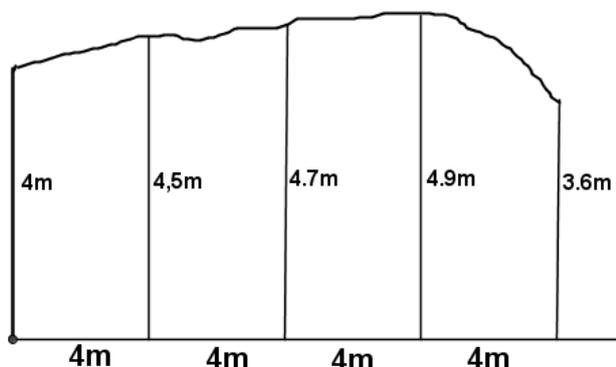


- 10.1.1 What is the maximum amount of water that is needed to fill in the pool? (3)
- 10.1.2 Calculate the cost of the paint that will be needed to paint the insides of the pool if the paint costs R50 per square metre. (4)

- 10.2 The diameter of the hemisphere in the plastic toy torch shown below is 8 cm and the length of the cylindrical part is 160 mm. Calculate the surface area of the toy.



- 10.3 The irregular shape below has one straight side divided into 4 equal parts 4 m apart. The ordinates dividing the parts are: 4 m, 4,5 m; 4,7 m, 4,9 m, 3,6 m.



Calculate the area using the mid-ordinate rule

(4)  
[16]

**TOTAL:**

**ANSWER SHEET**

**NAME:**

**CLASS:**

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