basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL
SENIOR CERTIFICATE

GRADE 10

TECHNICAL MATHEMATICS

EXEMPLAR 2016

MARKS: 100

TIME: 2 hours

This question paper consists of 9 pages and 1 diagram sheet.
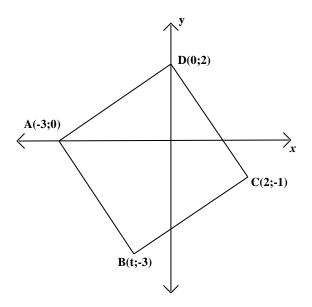
INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1.   This question paper consists of 8 questions.

2.   Answer ALL the questions.

3.   Clearly show ALL calculations, diagrams, graphs et cetera 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.   A DIAGRAM SHEET for answering QUESTION 4.1 is given at the end of the question paper. Detach and attach it in your answer book/ sheet.

8   You may use an approved scientific calculator (non-programmable and non-graphical)

9.   Write neatly and legibly.

QUESTION 1

In the diagram below, A(–3 ; 0), B(t ; –3), C(2 ; –1) and D(0 ; 2) are vertices of the quadrilateral ABCD.

1.1   Determine the gradient of DC.   (1)

1.2   Determine the co-ordinates of M, the midpoint of AC.   (2)

1.3   Hence, calculate the equation of the straight line passing through M and D.   (4)

1.4   If $AB = \sqrt{13}$, show that $t = -1$.   (4)

1.5   If $A\hat{D}C = 90^0$, what type of a quadrilateral is ABCD? Justify your answer with relevant calculations.   (4)

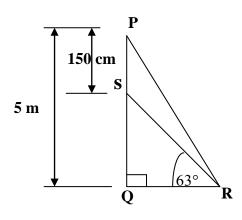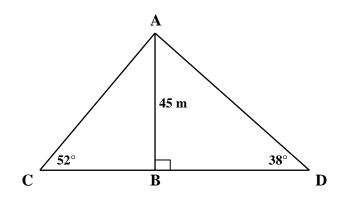   **[15]**

QUESTION 2

2.1   If $x = 43°$ and $y = 32,5°$, use a calculator to find the values of the following:

2.1.1 $\sin(x + y)$ (2)

2.1.2 $\sec\left(\dfrac{x-y}{2}\right)$ (2)

2.2   If $13\sin \alpha + 5 = 0$ and $90^0 < \alpha < 270^0$, determine the value of the following **with the aid of a sketch**:

2.2.1 $\cot \alpha$ (4)

2.2.2 $\cos \alpha + \tan \alpha$ (3)

2.3   Solve for x, if $\cot x = \tan 53^0 + \sin 233^0$.   (3)

                                                                                   [14]

QUESTION 3

3.1   PQ is a vertical wall that is 5 m high. A ladder, SR, is placed against PQ such that S is 150 cm below P and the ladder forms an angle of 63^0 with the ground.

            3.1.1   Calculate, in metres, the length of SQ.   (1)

            3.1.2   Calculate, in metres, the length of the ladder SR.   (2)

            3.1.3   Another ladder is placed at point R on the ground and reaches point P on the wall. This ladder makes an angle of 15^0 with the wall (that is $S\hat{P}R = 15^0$). Calculate the length of the ladder in metres.   (4)

3.2   AB, a vertical tower, is 45 m high. Two boys are standing on either side of the tower at C and D respectively, such that C, B and D lie in a straight line. The angle of elevation from C to A is 52^0 and the angle of elevation from D to A is 38^0.

            3.2.1   Calculate the length of BC.   (3)

            3.2.2   How far apart are the boys standing from each other?   (3)

                                                                                                [13]
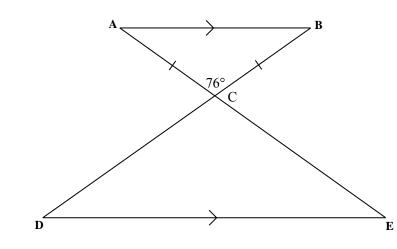
QUESTION 4

Given: $f(x) = \dfrac{1}{2}\tan x$ and $g(x) = \cos x + 1$

4.1   Use the set of axes provided on the attached DIAGRAM SHEET and draw the graph of f and g in the interval $x \in [0^0; 360^0]$.   (5)

4.2   Write down the equation(s) of the asymptote(s) of f in the given interval.   (1)

4.3   Write down the range of g.   (2)

4.4   For which value(s) of x is $f(x) = g(x)$ for $x \in [90^0; 360^0]$?   (2)

4.5   For which value(s) of x is $f(x) > g(x)$ for $x \in [90^0; 270^0]$?   (2)

[12]

QUESTION 5
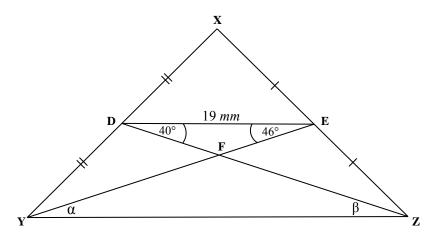
5.1   State a condition for two triangles to be similar.   (1)

5.2   In the diagram below, ABC is an isosceles triangle having AC = BC and $\hat{ACB} = 76^0$. AC is produced to E and BC is produced to D such that AB // DE.

5.2.1   Show that $\triangle ABC \, ||| \, \triangle EDC$.   (4)

5.2.2   State a condition that will make these triangles congruent.   (2)

5.3   In the diagram below, D and E are the midpoints of XY and XZ respectively. F is the point of intersection of DZ and EY.
DE = 19 mm, $Z\hat{D}E = 40^0$, $Y\hat{E}D = 46^0$, $E\hat{Y}Z = \alpha$ and $D\hat{Z}Y = \beta$.

Calculate, stating reasons:

5.3.1   The length of YZ   (2)
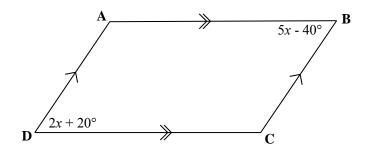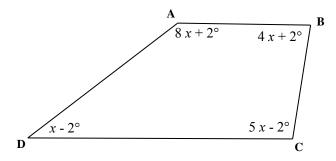
5.3.2   The size of α (2)

5.3.3   The size of $Y\hat{F}Z$ (2)

[13]

QUESTION 6

6.1   Quadrilateral ABCD is drawn below with AB // DC and AD // BC .

6.1.1   Why is the quadrilateral ABCD a parallelogram?   (1)

6.1.2   Calculate, with a reason, the value of x.   (4)

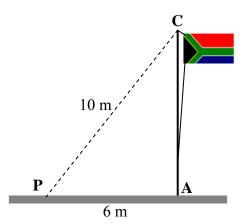6.2   In the diagram below, ABCD is a quadrilateral with interior angles in terms of x.

6.2.1   Calculate, giving a reason, the value of x.   (4)

6.2.2   Hence, show that ABCD is a trapezium.   (4)

[13]

QUESTION 7

In the diagram below, AC is a flag pole which is perpendicular to the ground. A boy has to calculate the height of the flag pole. He takes a rope that is tied at point C, pulls it tight and places it at point P which is 6 m from A. The length of the rope CP is 10 m. Triangle CAP is then formed.

7.1	Calculate, with a reason, the height of the flagpole.	(4)
7.2	What will the length of the rope be if the boy wants to place it 5 m away from A?	(3)
		[7]

QUESTION 8

8.1   Convert the following:

         8.1.1 $122,46^0$ to degrees-minutes-seconds   (3)

         8.1.2 $83^0 59' 13''$ to degrees   (3)

8.2   Determine the central angle, θ, that intercepts an arc with length 4 cm on a circle with radius 60 mm. Give your answer in degrees.   (4)

8.3   Simplify the following and leave your answer in degrees:

$$6\pi - 15^0 + \frac{4\pi}{3}$$

         (3)
         [13]

         TOTAL: **100**

DIAGRAM SHEET

QUESTION 4.1

SURNAME AND NAME	