education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

MATHEMATICS
(Second Paper)
NQF LEVEL 4

NOVEMBER 2009

(10501064)

5 November (Y-Paper)
13:00 – 16:00

This question paper consists of 7 pages and a 1-page formula sheet.

TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Read ALL the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Clearly show ALL calculations, diagrams, graphs, et cetera, which you have used in determining the answers.
5. Where necessary, answers should be rounded off to THREE decimal places, unless stated otherwise.
6. Diagrams are NOT drawn to scale.
7. Write neatly and legibly.

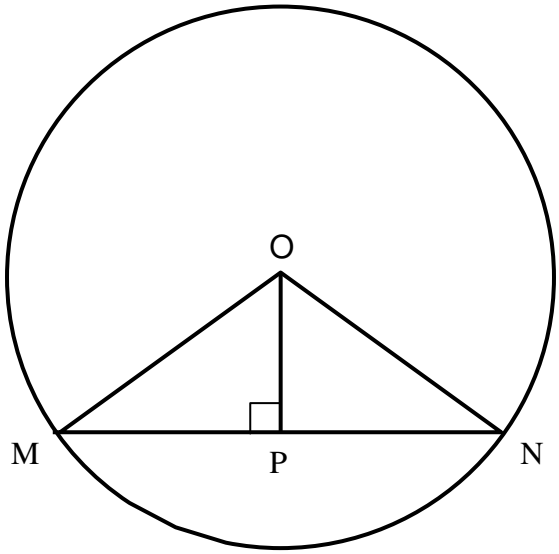
QUESTION 1

1.1 Complete the statements of the following theorems:

1.1.1 A line drawn from the centre of a circle that passes through the midpoint of a chord is … . (1)

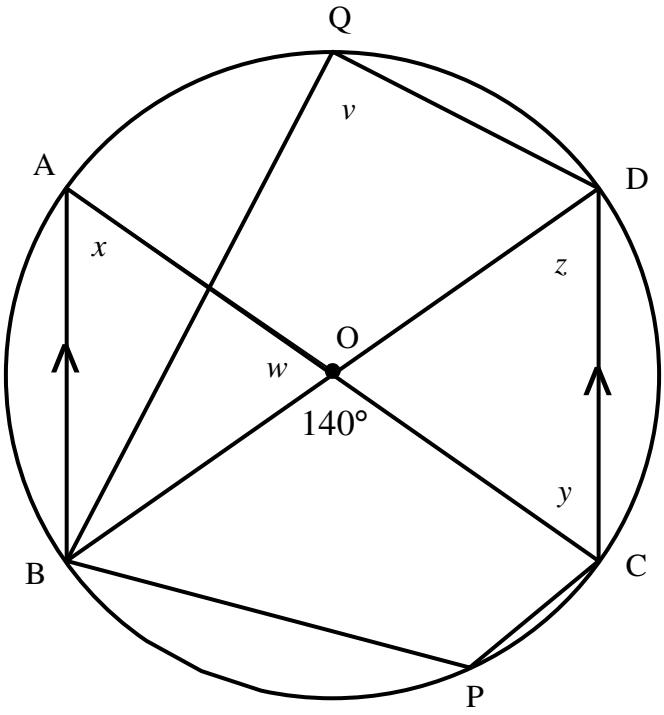
1.1.2 The angle at the circumference of a circle which is subtended by the diameter of the circle is … . (1)

1.2 In the figure below, O is the centre of the circle with OM being the radius to the circle.
MN = 200 mm and OP = 75 mm.
Determine, with reasons, the length of OM.



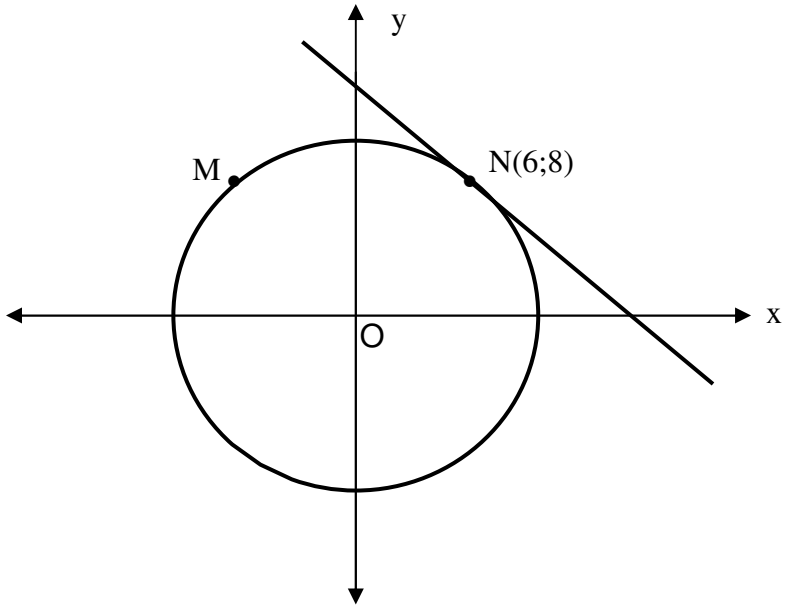
(4)

1.3 In the figure below, O is the centre of the circle. AC and BD are diameters. AB is parallel to CD and AC meets BD at O.
Determine, giving reasons, the values of *v*, *w*, *x*, *y* and *z*.



(10)

1.4 In the accompanying diagram N (6 ; 8) is a point on the circle with centre O (0 ; 0).



1.4.1 Determine the equation of the circle. (3)

1.4.2 Write down the gradient of ON. (2)

1.4.3 Determine the equation of the tangent to the circle at N. (5)

1.4.4 Points M and N are symmetrical about the Y-axis. Write down the co-ordinates of M. (2)

[28]

QUESTION 2

2.1 Evaluate $(2j)^5 \times j^9$ where $j = \sqrt{-1}$. (2)

2.2 Given $Z_1 = -3 + 4i \quad Z_2 = 2 - 6i$

Evaluate the following and write the final answer in rectangular form:

2.2.1 $\dfrac{Z_1}{Z_2}$ (5)

2.2.2 $Z_1 \times Z_2$ (3)

2.2.3 $Z_1 - Z_2$ (2)

2.3 Use De Moivre's Theorem to evaluate the following, leaving the answer in polar form:

$$\frac{(2\,cis\,300°)^5}{(\sqrt{8}\,cis\,135°)^2}$$

(3)

2.4 Simplify $\dfrac{6\,cis\,75{,}5^\circ \times 7\,cis\,23{,}5^\circ}{4\,cis\,80^\circ}$, writing your answer in polar form. (3)

2.5 Use the identical complex to solve for x and y if $(x+y)+i\,x-i\,y = 7+2i$. (4)

[22]

QUESTION 3

3.1 3.1.1 Convert $250°\ 30'$ to radians. (2)

3.1.2 Convert $\dfrac{\Pi}{9}$ radians to degrees. (1)

3.2 Use a calculator to determine the value(s) of θ in radians if $0° \le x \le 2\Pi$ radians of the following:

3.2.1 $8\cos x + 4 = 4{,}826$ (4)

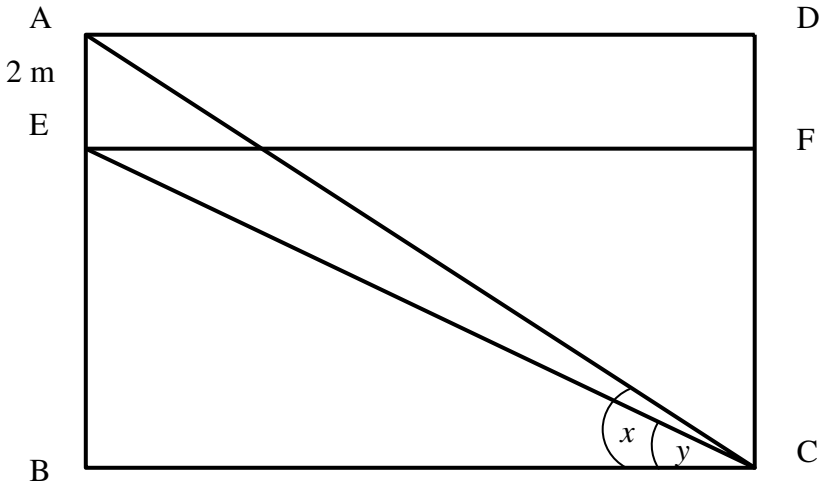
3.2.2 $1 - \cos^2 x - \cos x = 1$ (6)

3.2.3 $\sin(2x + \dfrac{\pi}{12}) = 0{,}5$ (8)

3.3 3.3.1 Write down the expansion for $Cos(A-B)$ in terms of angles A and B. (1)

3.3.2 Hence, or otherwise, derive a formula for $Sin(A+B)$ in terms of angles A and B. (4)

3.4 In the diagram below ABCD represents a rectangular wall of a room, $E\hat{C}B = y$



3.4.1 Apply the sine rule in triangle AEC to complete $\frac{AE}{\sin ACE} = \frac{EC}{...}$ (1)

3.4.2 Prove that $EC = \frac{2\cos x}{\sin(x-y)}$ (6)

3.4.3 Hence, or otherwise, calculate the area of the wall if $x = 33^\circ$ and $y = 20^\circ$ (7)

[40]

QUESTION 4

4.1 A person earns a basic salary of R92 508 per annum. She is required to contribute 1% of her salary towards the Unemployment Insurance Fund (UIF). Her employer is also expected to contribute a further 1% of her salary towards UIF. Calculate the total monthly contribution towards UIF. (3)

4.2 The table below shows the rates at which tax was levied in South Africa for the 2008 tax year. Thobile, who is 42 years old, earned a gross salary R10 890,00 per month (before the tax). She also received a bonus of R11 200,00 in December. Thobile did not earn any interest from investments during the tax year.

Use this information and the table to answer the following questions.

Rates applicable to individuals

Taxable Income	Rates of tax
R0 – R122 000	18% of every R1
R122 000 – R195 000	R21 960 + 25% of the amount over R122 000
R195 000 – R270 000	R40 210 + 30% of the amount over R195 000
R270 000 --R380 000	R62 710 + 35% of the amount over R270 000
R380 000 – R490 000	R101 210 + 38% of the amount over R 380 000
R490 000 and over	R143 010 + 40% of the amount over R490 000

Tax Rebates:
Primary rebate R7 200
Additional rebate (for persons 65 years and older) R4 500
Exemptions:
Annual exemption on interest earned for individuals younger than 65 years R19 000
Annual exemption on interest earned for individuals older than 65 years R19 000

[SOUTH AFRICAN REVENUE SERVICE (SARS) 2007/2008]

4.2.1 Calculate Thobile's total earnings per annum including the bonus. (2)

4.2.2 Calculate the after-tax income per month that Thobile earned if tax on her bonus was deducted on a monthly basis. (4)

4.2.3 Why did Thobile want the tax on her bonus to de deducted on a monthly basis? (1)

[10]

TOTAL: 100

FORMULAE SHEET

1. $Z = r\cos\theta + r\,j\sin\theta$

2. $Z = a \pm bj$ or $Z = a \pm bi$ *where* $i = j = \sqrt{-1}$

3. $r \angle \theta = r\ cis\ \theta$

4. Distance $= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

5. $\dfrac{\sin\theta}{\cos\theta} = \tan\theta$

6. $\dfrac{\cos\theta}{\sin\theta} = \cot\theta$

7. $\sin^2\theta + \cos^2\theta = 1$

8. $1 + \tan^2\theta = \sec^2\theta$

9. $1 + \cot^2\theta = \cos ec^2\theta$

10. $\sin(A \pm B) = \sin A\cos B \pm \sin B\cos A$

11. $\cos(A \pm B) = \cos A\cos B \mp \sin A\sin B$

12. $\tan(A \pm B) = \dfrac{\tan A \pm \tan B}{1 \mp \tan A\tan B}$

13 $\dfrac{\sin A}{a} = \dfrac{\sin B}{b} = \dfrac{\sin C}{c}$

14. $a^2 = b^2 + c^2 - 2bc\ \cos\hat{A}$

15 $A = \dfrac{1}{2}ab\sin\hat{C}$

16. $I = A_0 \times \dfrac{r}{100} \times t$ or $I = \dfrac{P\,r\,t}{100}$

17. $A_t = A_0\left(1 + \dfrac{r}{100 \times m}\right)^{t \times m}$ or $A_t = P(1 + \dfrac{r}{100})^n$

18. $A_t = A_o(1 - \dfrac{r}{100})^t$

19. $i = \dfrac{r}{100}$