higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

MATHEMATICS
(Second Paper)
NQF LEVEL 4

NOVEMBER 2012

(10501064)

5 November (Y-Paper)
13:00 – 16:00

Non-programmable scientific calculator may be used.

This question paper consists of 7 pages and a 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, etc, which you have used in determining the answers.
5. If 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

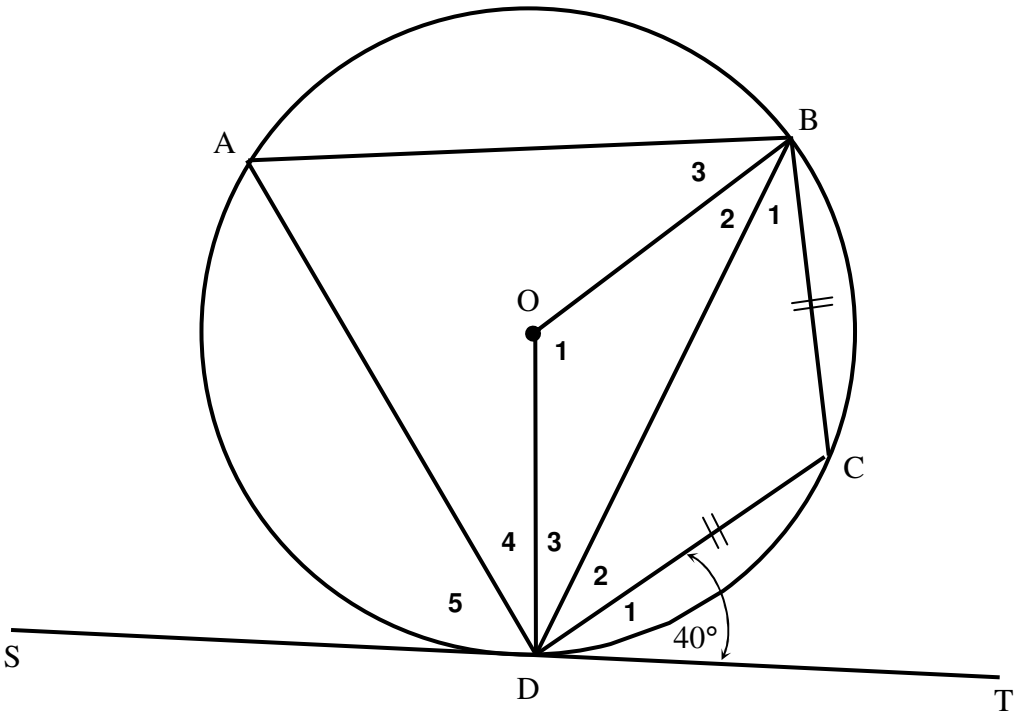
1.1 Complete the following theorems:

1.1.1 The angle subtended by a chord at the centre of a circle is … . (1)

1.1.2 The angle between a tangent to a circle and a chord from the point of contact is ... . (1)

1.1.3 The opposite angles of a cyclic quadrilateral are … . (1)

1.2 In the accompanying figure, O is the centre of the circle and ABCD is a cyclic quadrilateral. ST is a tangent to the circle at D and BC = CD.
$C\hat{D}T = 40°$



Determine the value of the following angles giving all reasons:

1.2.1 $B\hat{D}C$ (4)

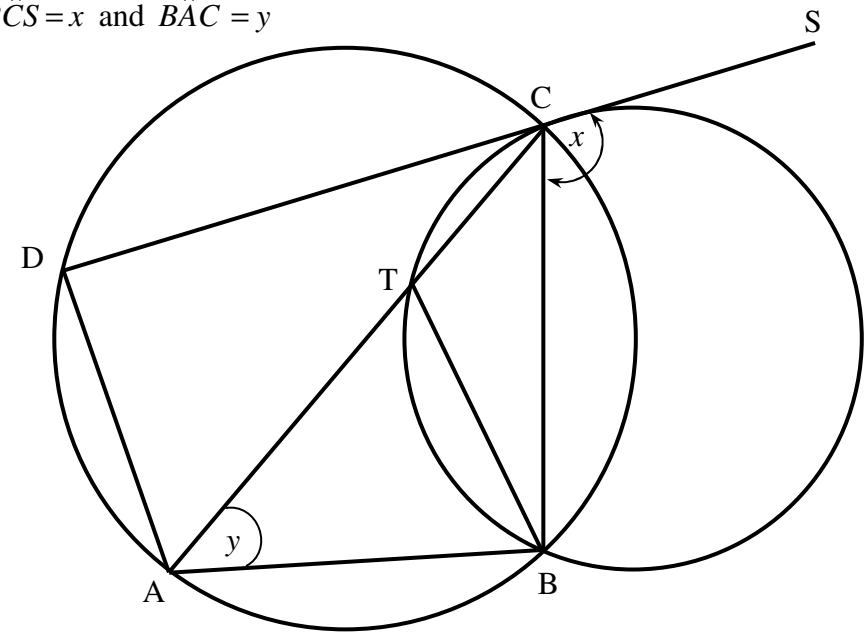
1.2.2 $\hat{C}$ (2)

1.2.3 $\hat{A}$ (2)

1.2.4 $\hat{O}_1$ (2)

1.3 In the following figure, ABCD is a cyclic quadrilateral. DC is a tangent to a circle through B, C and T. AC passes through T on the circle. DC is produced to S and TB is joined.

Let $B\hat{C}S = x$ and $B\hat{A}C = y$

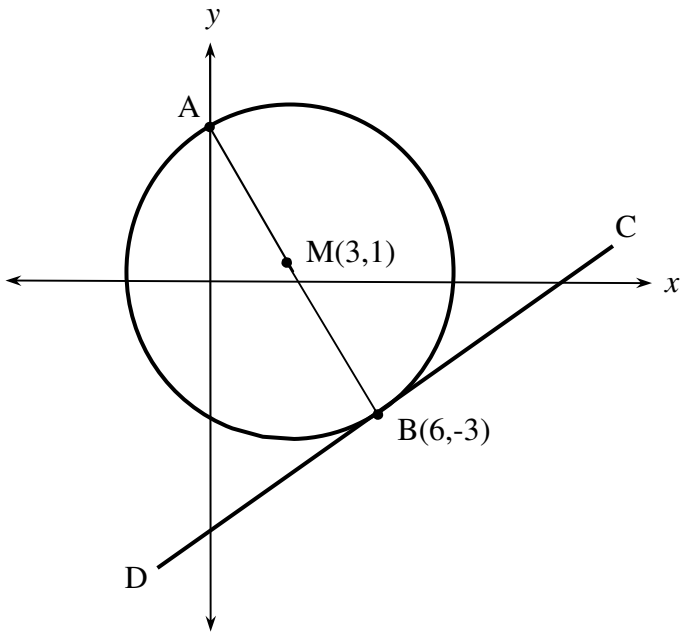


1.3.1 Name, giving reasons, TWO other angles that are equal to x (4)

1.3.2 Determine, giving reasons, the value of $A\hat{B}T$ in terms of x and y (2)

1.3.3 Hence, prove that DA is a tangent to circle ABT. (3)

1.4 In the diagram below a circle with centre M (3;1) is given. A is a point on the y axis. AB is the diameter of the circle and CD is a tangent to the circle at B (6;-3)



1.4.1 Determine the co-ordinates of point A. (3)

1.4.2 Determine the equation of the tangent to the circle at B. (5)

[30]

QUESTION 2

2.1 Write the following in the form $a+bi$

$$y=\frac{4\pm\sqrt{-36}}{2}$$ (2)

2.2 Simplify $\frac{(3+7i)(3-7i)}{3-5i}$ to the form $a+bi$ (4)

2.3 By making use of de Moivre's theorem simplify the following leaving your answer in polar form.

$$\frac{\sqrt[3]{8\,cis\,60°}}{\sqrt[4]{16\,cis\,120°}}\times\left(\frac{2\,cis\,25°}{3\,cis\,125°}\right)^{-3}$$ (6)

2.4 Solve for x and y in the following complex identities:

2.4.1 $i(x+iy)\,(x-iy)=2+4i-x$ (5)

2.4.2 $$\frac{(x+i\,y)(2-\sqrt{3}\,i)}{(-3+i)(-i)}=4-6i$$ (6)

[23]

QUESTION 3

3.1 Convert $380°$ to radians. (1)

3.2 In each of the following equations determine the value/s of θ in radians if $0\le\theta\le 6{,}282$ radians:

3.2.1 $\frac{1}{2}\cos\theta=0{,}435$ (4)

3.2.2 $\tan(\theta-30°)=1{,}57$ (5)

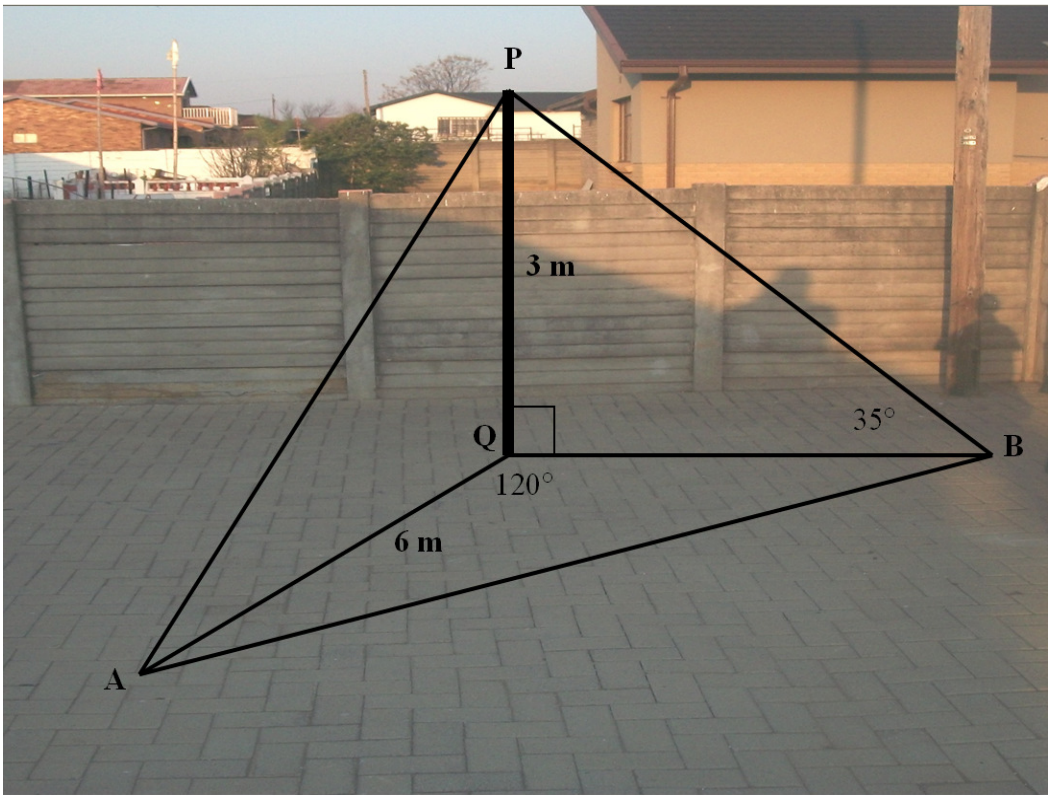
3.2.3 $6\cos\theta-5=\frac{4}{\cos\theta}$ (7)

3.3 If $90°<A<360°$ and $\tan A=\frac{2}{3}$, show without the use of a calculator that:

$$\cos 2A-\sin 2A=-\frac{7}{13}$$ (6)

3.4 Prove that $\cos(A+B)-\cos(A-B)=-2\sin A\,\sin B$ (4)

3.5 Points A, B and Q are in the same horizontal plane. PQ is a vertical pole of length 3 m. AQ = 6 m, the angle $A\hat{Q}B = 120°$ and the angle of elevation of P from B is $35°$.



3.5.1 Calculate the length of QB (3)

3.5.2 Hence, calculate the length of AB (4)

3.5.3 Determine the area of ΔABQ (3)

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QUESTION 4

4.1 Given below is the individual rate table obtained from the South African Revenue Services (SARS) for the 2011/2012 tax year.

Rates applicable to individuals

Taxable Income (R)	Rates of tax (R)
0 – 160 000	18% of taxable income.
160 001 – 250 000	28 800 + 25% of taxable income above 160 000
250 001 – 346 000	51 300 + 30% of taxable income above 250 000
346 001 – 484 000	80 100 + 35% of taxable income above 346 000
484 001 – 617 000	128 400 + 38% of taxable income above 484 000
617 001 and above	178 940 + 40% of taxable income above 617 000

Tax rebates applicable to individuals are:

- Primary rebate R11 440
- Additional rebate (for persons 65 years and older) R6 390
- Tertiary (person 75 or older) R2 130

Tax thresholds applicable to individuals are:

- Below age 65 R63 556
- Age 65 to below 75 R99 056
- Age 75 and over R110 889

SOUTH AFRICAN REVENUE SERVICE (SARS) 2011/2012

In the 2011/2012 tax year Gordan earned a basic salary of R300 000. He also had an investment of R500 000 in a 1-year fixed deposit account which earned interest at a rate of 8% per annum calculated once a year. His employer deducted a total tax of R75 000 for the 2011/2012 tax year. The tax payer is 45 years old.

4.1.1 Calculate the interest received from the investment for the tax year. (1)

4.1.2 The interest exemption for taxpayers below age 65 is R22 300. What portion of Gordan's interest income is taxable? (1)

4.1.3 Using the tax table above calculate the amount Gordan will either receive from SARS or the amount he has to pay to SARS. (5)

4.2 The price of a litre of milk at present is R8,00. The rate of inflation for the next 3 years is expected to be as follows: 7,5%; 8% and 8,2% respectively. Calculate the price of a litre of milk in 3 years time. (3)

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

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

13. $\sin 2\theta = 2\sin\theta\cos\theta$

14. $\cos 2\theta = \cos^2\theta - \sin^2\theta$

15. $\cos 2\theta = 1 - 2\sin^2\theta$

16. $\cos 2\theta = 2\cos^2\theta - 1$

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

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

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

20. $I = A_0 \times \dfrac{r}{100} \times t$ or $I = \dfrac{P\,r\,t}{100}$ or $A = P(1 + in)$

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

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

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