

higher education
& training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T930(E)(J28)T
AUGUST EXAMINATION
NATIONAL CERTIFICATE
MATHEMATICS N3
(16030143)

28 July 2014 (Y-Paper)
13:00–16:00

Diagrams are NOT drawn to scale.

This question paper consists of 7 pages, and 1 formula sheet of 2 pages.

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA
NATIONAL CERTIFICATE
MATHEMATICS N3
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
 2. Show ALL the calculations and intermediary steps.
 3. Questions may be answered in any order but subsections of questions must NOT be separated.
 4. ALL final answers must be accurately approximated to THREE decimal places.
 5. All graph work must be done in the ANSWER BOOK. Graph paper is NOT supplied.
 6. A formula sheet is attached to this question paper. The list is NOT necessarily complete. Any other applicable formula may be used.
 7. Write neatly and legibly.
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QUESTION 1

- 1.1 Simplify the following WITHOUT using a calculator: (5)

$$\frac{2^{a+1} \times \sqrt[3]{8^{a+1}}}{4^{a-1}}$$

- 1.2 Prove that $(\log_c a)(\log_b c)(\log_a b) = 1$ (3)

- 1.3 Determine the factors of the following function if $x - 1$ is one of the factors.
 $f(x) = x^3 + 3x^2 - x - 3$ (4)

- 1.4 Factorise the following expressions as far as possible in prime factors

1.4.1 $x^2(x-1) + (1-x)$ (3)

1.4.2 $a^2 + 2a - 3 + ab - b$ (3)

- 1.5 Simplify the following:

$$\frac{a^2 - b^2}{2a - b} \div \frac{a^2 - 2ab + b^2}{4a^2 - b^2} \times \frac{a - b}{a + b}$$
 (4)

[22]

QUESTION 2

- 2.1 Solve for 'a' by completing the square:

$$4a^2 - 12a - 7 = 0$$
 (5)

- 2.2 Solve for 'x':

2.2.1 $2^{x+2} + 2^{x-2} + \left(\frac{1}{2}\right)^{-x} = 42$ (4)

2.2.2 $\frac{2x}{x-1} - \frac{4}{x+1} = \frac{4-x}{x^2-1}$ (4)

- 2.3 Make 'n' the subject of the formula :

$$P = 100e^{-0,3n}$$
 (4)

- 2.4 Make 'r' the subject of the formula:

$$a = \pi r^2 + \pi r s$$
 (2)

- 2.5 Calculate the coordinates of the points of intersection of the graphs defined by the following two equations:

$$y = 2x^2 - 8x - 10 \quad (4)$$

$$y = -9x$$

- 2.6 The product of two consecutive odd numbers is 143. Calculate the numbers. (3)

[26]

QUESTION 3

- 3.1 $\triangle ABC$ has vertices $A(2;3)$, $B(-2;-1)$ and $C(4;1)$.

3.1.1 Draw $\triangle ABC$ on a set of axes. (1)

3.1.2 Determine the gradient of AB . (1)

3.1.3 Determine the angle of inclination of the line AB . (1)

3.1.4 Show that AB is perpendicular to AC . (2)

3.1.5 Determine the equation of the line through C and parallel to AB . (3)

3.1.6 Find D and E , the midpoints of AC and BC respectively. (4)

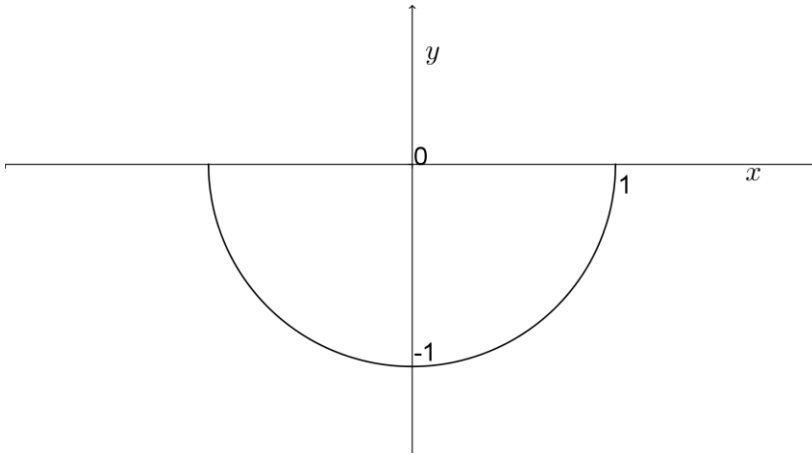
3.1.7 Show that $AB = 2DE$ (5)

- 3.2 Choose a description from COLUMN B that matches an item in COLUMN A. Write only the letter (A-G) next to the question number(3.2.1-3.2.4) in the ANSWER BOOK.

COLUMN A	COLUMN B
3.2.1 	A $x^2 + y^2 = 10$ B $\frac{x}{1} + \frac{y}{10} = 100$ C $\frac{x^2}{1} + \frac{y^2}{10} = 100$

(2)

3.2.2



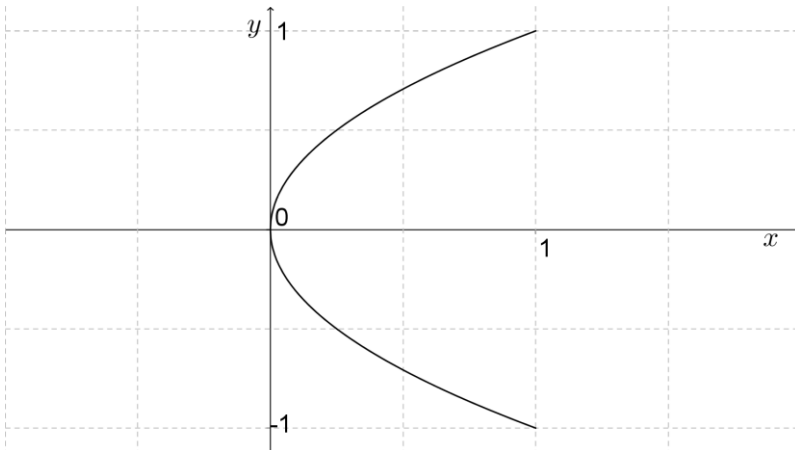
D $x = y^2$

E $y = -\sqrt{1-x^2}$

F $\frac{x^2}{1} + \frac{y^2}{1} = 1$

(2)

3.2.3



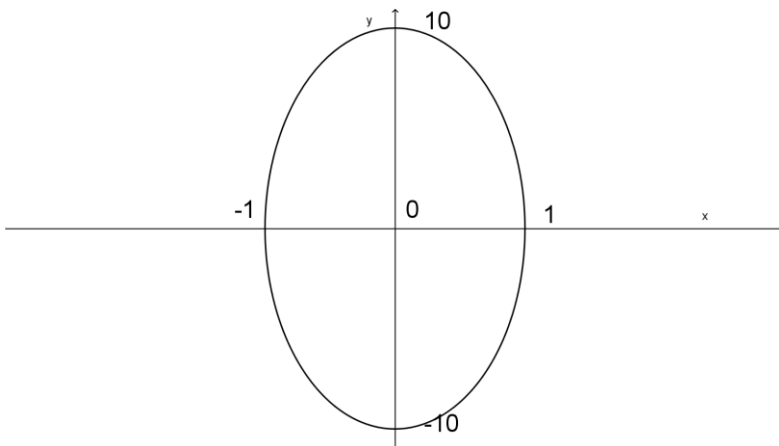
G $\frac{x}{1} + \frac{y}{1} = 1$

H $y = x^2$

I $\frac{x^2}{1} + \frac{y^2}{100} = 1$

(2)

3.2.4



(2)

[25]

QUESTION 4

- 4.1 Determine $\frac{dy}{dx}$ by making use of the rules of differentiation. Write your answer with positive exponents and in surd form when applicable.

4.1.1 $y = 2\sqrt{x} - \frac{2}{x}$ (4)

4.1.2 $y = \frac{x^8 - 1}{x^4 + 1}$ (2)

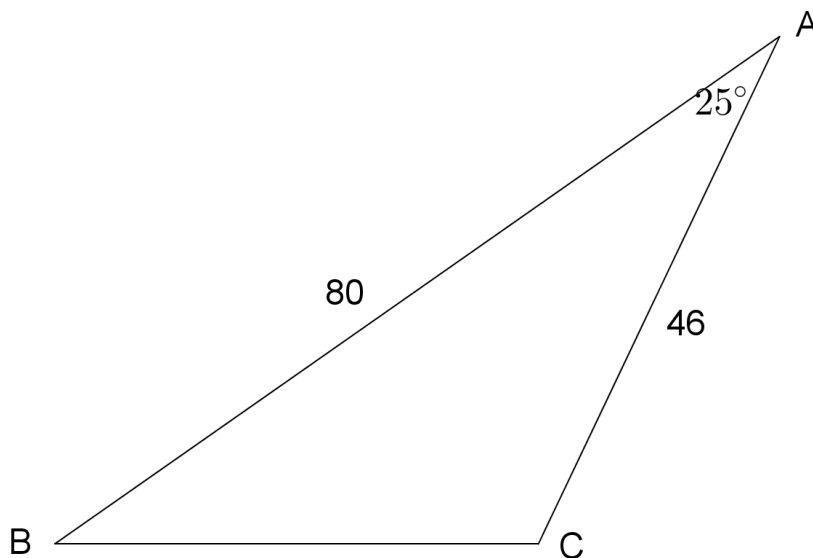
- 4.2 Determine the gradient of the tangent to the following curve at the point where $x = 2$:
 $y = (x^2 - 3)(x + 1)$ (3)
[9]

QUESTION 5

- 5.1 Make use of basic trigonometric identities to prove that
 $\frac{1 + \sin \theta}{\cos \theta} + \frac{\cos \theta}{1 + \sin \theta} = 2 \sec \theta$ (5)

- 5.2 Given: $\triangle ABC$ with $\hat{BAC} = 25^\circ$, length $AB = 80$ and length $AC = 46$.

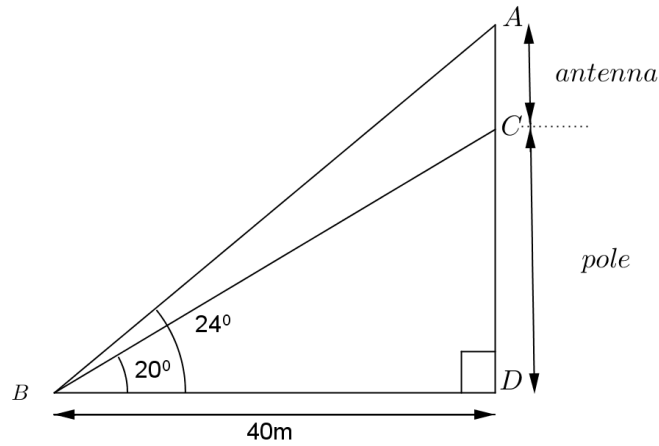
Use the cosine rule to determine the length of BC . (3)



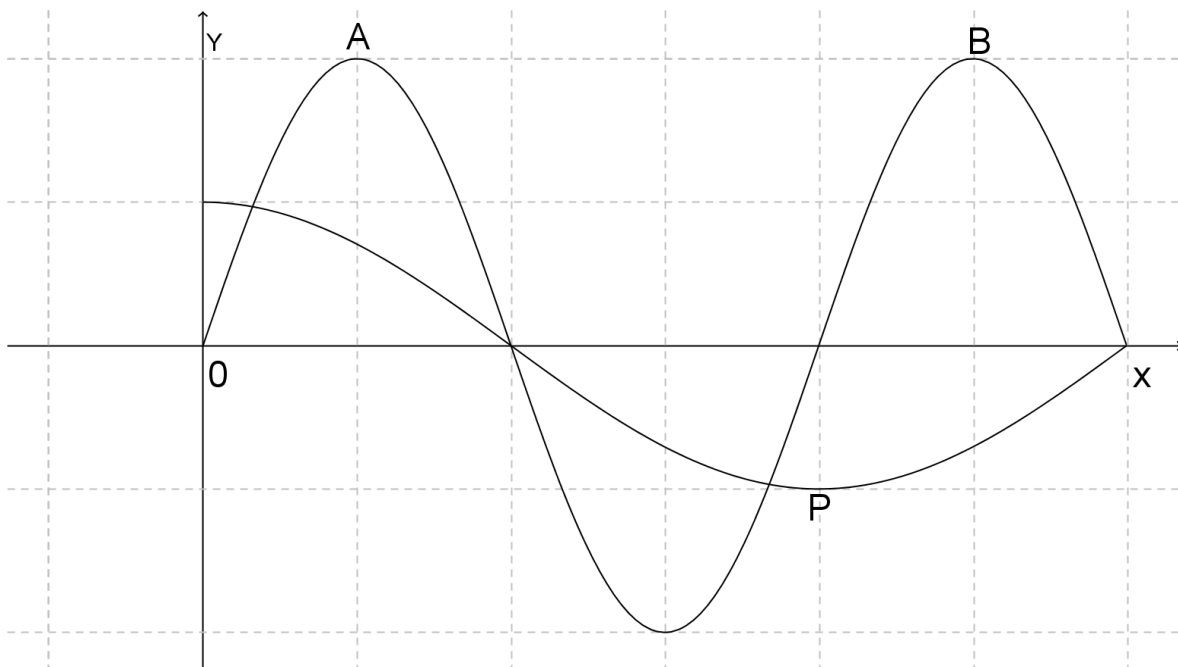
- 5.3 Solve the following equation if $0^\circ \leq \beta \leq 360^\circ$:

$2 \sec \beta + 4 = 0$ (3)

- 5.4 A vertical antenna AC is mounted on top of a pole CD . The technician measures the angles of elevation of two points on the antenna at a distance of 40 m from D , the base of the pole. If the angles, \hat{CBD} and \hat{ABD} , are 20° and 24° respectively, find the length of the antenna. (4)



- 5.5 The graphs represent the functions $f(x) = 2\sin 2x$ and $g(x) = \cos x$. A, B and P are turning points. Determine the coordinates of A, B and P . (3)



[18]

MATHEMATICS N3**FORMULA SHEET**

Any applicable formula may also be used.

1. Factors/Faktore

$$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$$

$$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$$

**3. Quadratic formula/
Kwadratiese formule**

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

4. Parabola/ Parabool

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

$$y = \frac{4ac - b^2}{4a}$$

$$x = \frac{-b}{2a}$$

5. Circle/ Sirkel

$$x^2 + y^2 = r^2$$

$$D = \frac{x^2}{4h} + h$$

$$x = \sqrt{4Dh - 4h^2}$$

2. Logarithms/ Logaritmes

$$\log ab = \log a + \log b$$

$$\log \frac{a}{b} = \log a - \log b$$

$$\log_b a = \frac{\log_c a}{\log_c b}$$

$$\log a^m = m \log a$$

$$\log_b a = \frac{1}{\log_a b}$$

$$\log_a a = 1 \therefore \ln e = 1$$

$$a^{\log_a t} = t \therefore e^{\ln m} = m$$

6. Straight line/ Reguitlyn

$$y - y_1 = m(x - x_1)$$

Perpendicular:

$$\text{Loodreg: } m_1 \cdot m_2 = -1$$

Parallel lines:

$$\text{Ewewydige lyne: } m_1 = m_2$$

Distance:

$$\text{Afstand: } D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Midpoint:

$$\text{Middelpunt: } P = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

Angle of inclination:

$$\text{Hellingshoek: } \theta = \tan^{-1} m$$

7. Differentiation/ Differensiasie

$$\frac{dy}{dx} = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

$$\frac{d}{dx} (x^n) = nx^{n-1}$$

Max/Min
Maks/Min

For turning points:

Vir draaipunte: $f'(x) = 0$

8. Trigonometry/ Trigonometrie

$$\sin\theta = \frac{y}{r} = \frac{1}{\operatorname{cosec}\theta}$$

$$\cos\theta = \frac{x}{r} = \frac{1}{\operatorname{sec}\theta}$$

$$\tan\theta = \frac{y}{x} = \frac{1}{\operatorname{cot}\theta}$$

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

$$1 + \tan^2\theta = \operatorname{sec}^2\theta$$

$$1 + \cot^2\theta = \operatorname{cosec}^2\theta$$

$$\tan\theta = \frac{\sin\theta}{\cos\theta}$$

$$\cot\theta = \frac{\cos\theta}{\sin\theta}$$

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

$$a^2 = b^2 + c^2 - 2bc \cos A$$