
DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA
NATIONAL CERTIFICATE
MATHEMATICS N3
TIME: 3 HOURS *August 2012*
MARKS: 100

INSTRUCTIONS AND INFORMATION

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

1. Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A – E) next to the question number (1.1 – 1.10) in the ANSWER BOOK.

1.1 If a and b are positive real numbers, then $(a^0 - 3b^0)^5 =$

- | | | | | |
|---|-----|---|----|-----|
| A | 0 | B | 1 | |
| C | -32 | D | 32 | |
| E | 243 | | | (1) |

1.2 Which ONE of the following is equal to $\log_a(xy)$?

- | | | | | |
|---|-----------------------------|---|-----------------------|-----|
| A | $(xy)^a$ | B | $\log_a x + \log_a y$ | |
| C | $(\log_a x)(\log_a y)$ | D | $(a^x)(a^y)$ | |
| E | None of the above-mentioned | | | (1) |

1.3
$$\frac{\frac{x}{y} + \frac{y}{x}}{\frac{x}{y} - \frac{y}{x}} =$$

- | | | | | |
|---|-------------------------------|---|-------------------------------|-----|
| A | -1 | B | $\frac{x+y}{x-y}$ | |
| C | $\frac{x^2 - y^2}{x^2 + y^2}$ | D | $\frac{x^2 + y^2}{x^2 - y^2}$ | |
| E | $\frac{x-y}{x+y}$ | | | (1) |

1.4 If $(x+1) = 1$, what is the value of x ?

- | | | | | |
|---|-------|---|-------|-----|
| A | 0 | B | 1 | |
| C | -1 | D | $e+1$ | |
| E | $e-1$ | | | (1) |

- 1.5 Find the real solution for x to the exponential equation $e^{3x} = 1$.
- A No real solutions B $x = \frac{\ln 1}{3}$
- C $x = \frac{1}{\ln 3}$ D $x = 0$
- E $x = \frac{1}{3}$ (1)
- 1.6 Determine the equation of the line with an inclination of 45° and which passes through (0;4).
- A $y - 4x = 1$ B $y + 4 = -x$
- C $y + x = 4$ D $x = 0 + 4$
- E $x = \frac{1}{3}$ (1)
- 1.7 A fence around a square garden has a perimeter of 48 metres. Find the approximate length of the diagonal of this square garden.
- A 12 meter B 17 meter
- C 288 meter D 24 meter
- E 144 meter (1)
- 1.8 The curve $y = x^3 - x^2 - x - 8$ has a local minimum at the point ...
- A (1; 0) B (0; -8)
- C $\left(-\frac{1}{3}; 0\right)$ D (1; -9)
- E $\left(\frac{1}{3}; 1\right)$ (1)

1.9 $\frac{d}{dx} \left[x^{-\frac{2}{3}} \right]$ is equal to ...

A $\frac{2}{3} x^{-\frac{5}{3}}$

B Cannot be found

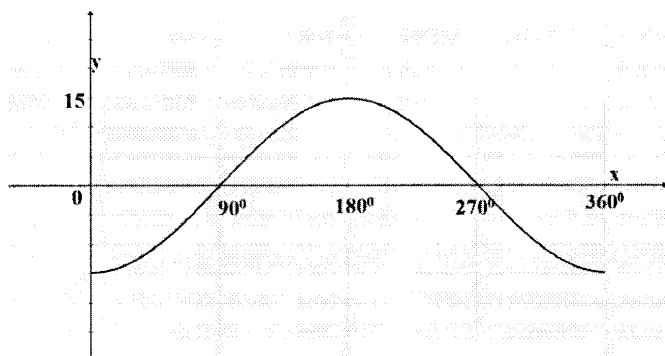
C $-\frac{2}{3\sqrt{x}}$

D $\frac{-2}{3\sqrt{x^5}}$

E $-\frac{2}{3} x^{\frac{1}{3}}$

(1)

1.10 A radio transmitter sends a radio wave from the top of a 15 m tower? The wave is represented by the graph below. What is the equation of this radio wave?



A $y = 20 \sin x$

B $y = -15 \sin x$

C $y = 15 \cos x$

D $y = -\cos x$

E $y = -20 \cos x$

(1)

[10]

QUESTION 2

2.1 Simplify the following without using a calculator.

2.1.1 $\log_3 15 - \log_3 10 + \log_3 18$ (3)

2.1.2 $4^{-2} + \frac{5}{4} \div \frac{4}{3}$ (2)

2.1.3 $\frac{2\sqrt{27} - \sqrt{108} + \sqrt{75}}{3\sqrt{12}}$ (3)

2.2 Fully factorise the following:

2.2.1 $8x^2 - 2(x+1)^2$ (3)

2.2.2 $(a+b)x^2 - 2ax - 2bx + b + a$ (3)

2.2.3 $m^{36} - 15m^{18} + 54$ (3)

2.3 Prove that $x - a$ is a factor of the following:

$f(x) = -x^3 + (a+3)x^2 - x(3a+3) + 3a$ (3)

2.4 Simplify without the use of a calculator, to a single fraction, then rationalise the denominator:

$\frac{1}{\sqrt{5}} + \sqrt{5}$ (2)

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QUESTION 3

3.1 Solve for x in each of the following:

3.1.1 $3^x + 3^{x+1} = 36$ (3)

3.1.2 $\frac{1}{x-2} - \frac{x}{x+2} = \frac{2}{x^2-4}$ (3)

3.2 Make 'x' the subject of the formula by completing the square:

$ax^2 + bx + c = 0$ (4)

3.3 Determine the value of 'd' in the following equation:

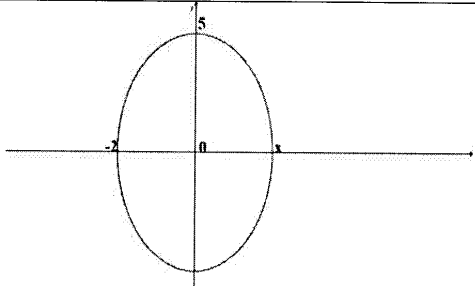
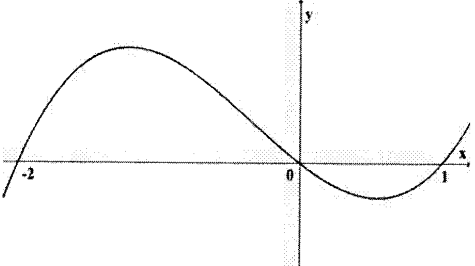
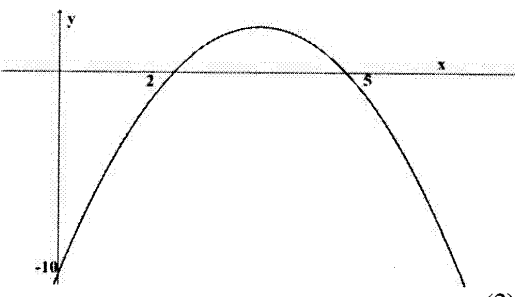
$A = \frac{\pi}{4}(D^2 - d^2)$ if: $A = 5,616 \text{ mm}^2$; $D = 3,4$; and $\pi = 3,142$ (3)

3.4 The length of a rectangular swimming pool is 5 m more than its breadth. If the perimeter of the rectangular swimming pool is 30 m, find its length and breadth. (4)

[17]

QUESTION 4

4.1 Three graphs named 4.1.1 – 4.1.3 are sketched below. Match the graphs (COLUMN A) with the equations (COLUMN B). Write down 4.1.1 – 4.1.3 and alongside these, the number selected from (1) to (10) that is the equation of the graph in your ANSWER BOOK.

COLUMN A	COLUMN B
<p>4.1.1</p> 	<p>1. $y = \sqrt{(4-x)(4+x)}$</p> <p>2. $y = x(x+1)(x-2)$</p> <p>3. $\frac{x^2}{4} + \frac{y^2}{25} = 1$</p> <p>4. $y = x^2 - 7x + 10$</p>
<p>4.1.2</p> 	<p>(2) 5. $y = (x-2)(x-5)$</p> <p>6. $y = -x^2$</p> <p>7. $25x^2 + 4y^2 = 100$</p> <p>8. $y = \sin x$</p> <p>9. $y = x^2 + 7x - 10$</p>
<p>4.1.3</p> 	<p>(2) 10. $y = x(x-1)(x+2)$</p>

(6)

4.2 Given:

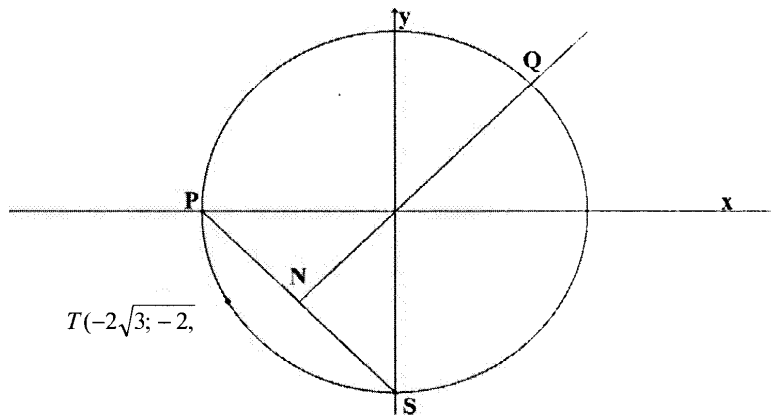
$$y = -2x + 14$$

$$2y = 7x - 5$$

4.2.1 Determine the points of intersection of the lines algebraically. (4)

4.2.2 Make a neat rough sketch showing the lines and the solutions obtained. (3)

4.3 The circle with the centre at the origin passes through the point $T(-2\sqrt{3}; -2)$ and cuts the x -axis and y -axis at P and S respectively.



4.3.1 Show that the equation of the circle is $x^2 + y^2 = 16$ (2)

4.3.2 Determine the coordinates of P and S. (2)

4.3.3 Determine the equation of the line PS. (3)

4.3.4 Determine the equation of the straight line QN which is perpendicular to PS and which passes through the origin. (3)

4.3.5 Calculate the coordinates of N if QN meets PS at N. (2)

4.4 Determine the equation of the line parallel to $y - 3x + 2 = 0$ and passing through (3; 1). (3)

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QUESTION 5

- 5.1 Determine $f'(x)$ by using the rules of differentiation. Leave the answer(s) with positive exponents and in surd form.

$$f(x) = \frac{5}{x} + \frac{x}{5} + \sqrt{x} \tag{3}$$

- 5.2 Differentiate the following from first principles:

$$y = 2x^2 \tag{4}$$

[7]

QUESTION 6

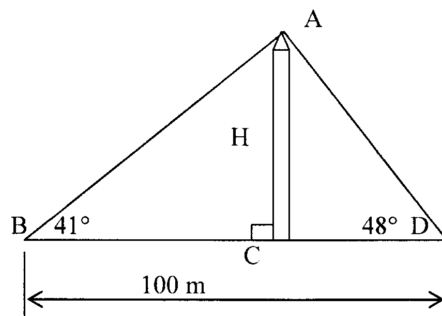
- 6.1 Make use of trigonometric identities to prove the following identity:

$$\frac{1 + \cos A}{\sin A} + \frac{\sin A}{1 + \cos A} = 2 \operatorname{cosec} A \tag{4}$$

- 6.2 Calculate the values of β that will satisfy the following trigonometric equation for $0^\circ \leq \beta \leq 360^\circ$:

$$3 \cot \beta + 2 = 9,5 \tag{4}$$

- 6.3 The sketch shows a tower between two points B and D. The two points are 100 m apart.

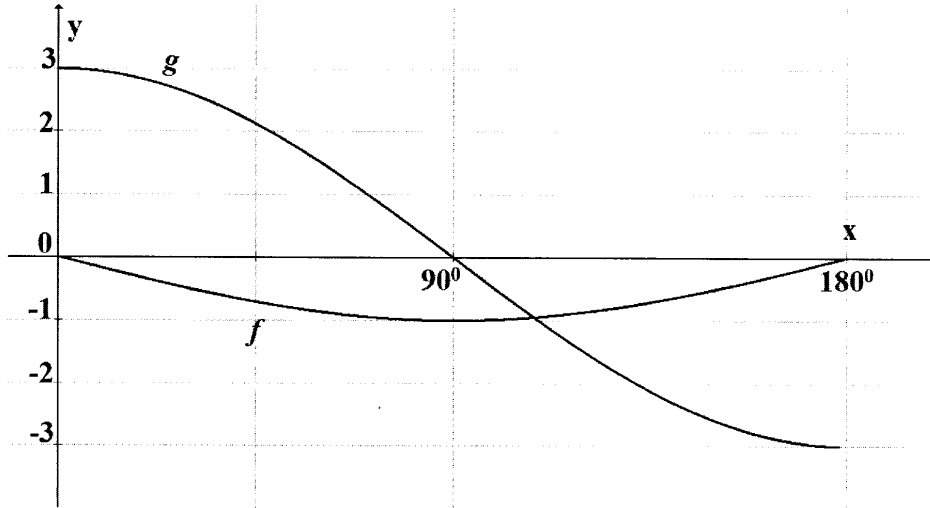


Determine the following:

- 6.3.1 The lengths of BC and CD (4)

- 6.3.2 The height of the tower (2)

- 6.4 The following graph represents the function f and g for $x \in [0^\circ; 180^\circ]$ where $f(x) = \sin ax$ and $g(x) = b \cos x$. Find the values of a and b .



(2)
[16]

TOTAL: 100