higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1382(E)(N19)T
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NATIONAL CERTIFICATE

MATHEMATICS N2

(16030192)

19 November (X-Paper)
09:00 – 12:00

REQUIREMENTS: **Graph paper.**

This question paper consists of 7 pages and a 2-page information sheet.

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
MATHEMATICS N2
TIME: 3 HOURS
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. Write neatly and legibly.

QUESTION 1

1.1 Various options are given as possible answers to the following questions. Write only the letter (A – D) next to the question number (1.1.1 – 1.1.10) in the ANSWER BOOK.

1.1.1 How can ¼ be expressed in terms of base 2?

A 2^{-2}
B 2^{-3}
C 2^{2}
D 2^{1} (1)

1.1.2 The *log100* is the same as:

A 20
B 10
C 10^{2}
D 2 (1)

1.1.3 The trig-function $\tan\theta$ is positive in … quadrants.

A first and fourth
B second and first
C first and third
D all four (1)

1.1.4 If you factorise $\left(a^2-(a-b)^2\right)$ the answer will be ...

A $(b-a)(a+b)$.
B $(a-(a-b))(a+(a-b))$.
C $\left(a^2+b\right)\left(a^2-b\right)$.
D $\left(a^2+b^2\right)\left(a^2-b^2\right)$. (1)

1.1.5 How many degrees are in a radian?

A 57,3°
B 60,5°
C 67,5°
D 43,6° (1)

1.1.6 $\left(a^{\circ}.b^{\circ}\right)$ is the same as ...

A $a^{-3}.b^{-3}$
B $a.b$
C 1
D -3 (1)

1.1.7 a^{-x} is the same as ...

A $\frac{x}{a}$
B $\frac{1}{ax}$
C $\frac{1}{a^x}$
D $\frac{a}{x}$ (1)

1.1.8 $\sqrt{8}$ can be expressed as ...

A $2\sqrt{3}$.
B $2\sqrt{2}$.
C $3\sqrt{2}$.
D $3\sqrt{3}$. (1)

1.1.9 How can $2^x = 3$ be expressed in terms of a logarithm?

A $3 = \log_x 2$
B $x = \log_2 3$
C $3 = \log_2 x$
D $2 = \log_3 x$ (1)

1.1.10 Express $\log_7 2 + \log_7 14$ as a single logarithm:

A $\log 24$
B $\log_7 7$
C $\log_7 28$
D $\log_7 16$ (1)

1.2 Indicate whether the following statements are TRUE or FALSE. Write only 'true' or 'false' next to the question number (1.2.1 – 1.2.10) in the ANSWER BOOK.

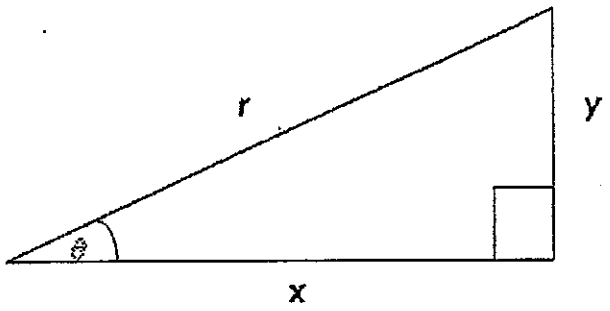
1.2.1 $\log_b x = y$ can be expressed as $x = b^y$. (1)

1.2.2 $A^\circ \neq 1$. (1)

1.2.3 If $8^x = 1$; then is $x = 0$. (1)

1.2.4 The $\log_2 0{,}25 = -2$. (1)

1.2.5 In the figure below, the $\cos ec\theta = \frac{x}{y}$.



(1)

1.2.6 The expression $\sqrt{x^2 + y^2}$ is not equal to $x + y$. (1)

1.2.7 $\sqrt[3]{125x^3} = 25x$. (1)

1.2.8 There is 0,143 revolutions in 51°22'. (1)

1.2.9 $\tan\theta \cos ec\theta$ is not equal to $\sec\theta$. (1)

1.2.10 The $\log_x a$ can be written as $\frac{\log a}{\log x}$. (1)
[20]

QUESTION 2

2.1 Factorise:

2.1.1 $5x^2 + 14x - 3$ (2)

2.1.2 $a^4 - 81$ (3)

2.1.3 $28xz - 21yz - 20xy + 15y^2$ (4)

2.2 Determine the highest common factor (HCF) of:

$12(x^2 - 4)$
$30(x^2 - 4x + 4)$
$6(x^2 - x - 6)$ (4)

2.3 Simplify:

2.3.1 $2\log_3 2 + \log_3 10 + \log_3 3 - \log_3 40$ (3)

2.3.2 $\frac{a^2 - 2a - 8}{2a + 6} \times \frac{4a + 12}{a^2 - 4}$ (4)
[20]

QUESTION 3

3.1 Solve for x by using the quadratic formulae:

$2x^2 - 3x - 4 = 0$ (4)

3.2 Solve for x in the following equations:

3.2.1 $\log_2 x = 4$ (2)

3.2.2 $\log_x 9 = 2$ (2)

3.2.3 $4{,}3^x = 36$ (2)

3.3 Use natural logarithms to determine the value of:

$\sqrt[4]{4357,45}$ (3)

3.4 Make 'a' the subject of the formulae:

$$H=\sqrt{\frac{a^2}{4}+h^2}$$ (3)

3.5 Solve for 'x' and 'y' in the following simultaneous equation:

$3x-4y=3$ and $2x+5y=25$ (4)
[20]

QUESTION 4

4.1 If the radius of a wheel is 20 mm and it turns at 32 revolutions per second, then calculate:

4.1.1 Angular velocity (2)

4.1.2 Peripheral velocity (2)

4.2 The circumference of a circle is 155 cm. Calculate the radius as well as the arc length of a sector which is 30°. (5)

4.3 A metal structure forms the pinnacle of a church tower built of face bricks. The brick section is 43,42 m high. The angle of elevation from a point on the ground to the top of the pinnacle is 40°15' and to the bottom of the pinnacle, the angle of elevation is 36°10'.
Calculate the height of the pinnacle. (6)

4.4 If $\sin\theta=\frac{4}{5}$ and $90^\circ \le \theta \le 180^\circ$ determine the following:

4.4.1 $\tan\theta$ (3)

4.4.2 $\sec\theta$ (2)
[20]

MATHEMATICS N2

INFORMATION SHEET

This sheet must accompany the question paper.

The right cone
Volume = $\frac{1}{3}\pi r^2 h$

Surface area $= \pi r\sqrt{h^2 + r^2} + \pi r^2$

$= \pi r\ell + \pi r^2$

The right pyramid
Volume = $\frac{1}{3}$ (area of base) × (perpendicular height)

The prism
Volume = (area of base) × (perpendicular height)

The cylinder
Volume = $\pi r^2 h$
Surface area = $2\pi r^2 + 2\pi rh$

The sphere
$V = \frac{4}{3}\pi r^3$; $A = 4\pi r^2$

Degrees and radians
180° = π rad

Sector: $\theta = \frac{\text{arc}}{\text{radius}}$; $A = \frac{1}{2}r^2\theta$

Angular velocity and circumferential velocity
Angular velocity: $w = 2\pi n$
Circumferential velocity: $v = \pi Dn$
n = rotation frequency (r/s = revolution per second)

Mid-ordinate rule
Area = (distance between ordinates) × (sum of mid-ordinates)

$$= \left[\frac{\text{First ordinate} + \text{Last ordinate}}{2} + \text{Sum of other ordinates}\right]$$

Multiply by the distance between the ordinates.

Graphs
Straight line: $y = mx + c$ Parabola: $y = ax^2 + bx + c$

Axis of symmetry: $x = \frac{-b}{2a}$

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

Trigonometry

$90° < \theta < 180°$ $\sin \theta = \sin (180° - \theta)$ $\cos \theta = -\cos (180° - \theta)$

$\tan \theta = -\tan (180° - \theta)$

Segments of circles

Chord length = x Height of segment = h Diameter of circle = D

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

Regular polygons

Angle subtended at centre of circumscribed circle by one side:

$$\theta = \frac{360°}{\text{number of sides}}$$

R = radius of circumscribed circle
x = length of side

$$x = 2R \sin \frac{\theta}{2}$$

Annulus: $A = \pi\left(R^2 - r^2\right)$