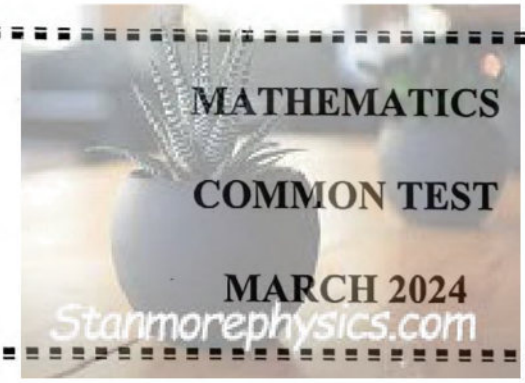
KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11



MARKS: 75

TIME: 1½ hours

This question paper consists of 6 pages.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 4 questions.
2. Answer ALL the questions.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining your answers.
5. Answers only will NOT necessarily be awarded full marks.
6. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
7. If necessary, round off answers correct to TWO decimal places, unless stated otherwise.
8. Write neatly and legibly.

QUESTION 1

1.1 Solve for x:

1.1.1 $2x^2 + 5x = 0$ (3)

1.1.2 $-4x^2 + 3x + 6 = 0$ (answer correct to TWO decimal places) (3)

1.1.3 $3\sqrt{x-2} = x$ (4)

1.2 Given: $x^2 - x - 20 < 0$

1.2.1 Solve for x if $x^2 - x - 20 < 0$. (3)

1.2.2 Hence, or otherwise, determine the sum of all the integers satisfying the inequality $x^2 - x - 20 < 0$. (2)

1.3 Solve simultaneously for x and y:

$4x + y = 7$ and $3x^2 + 2xy = y^2$ (6)

1.4 The roots of a quadratic equation are $x = \dfrac{-3 \pm \sqrt{13 - 2k}}{4}$.

Calculate the value(s) of k for which the roots are equal. (2)

1.5 Given: $(x+5)^2 = 1 - p^2$

Calculate the values of p for which the roots of the equation are non-real. (5)

[28]

QUESTION 2

2.1 **Simplify fully without using a calculator.** Your answer must be free of negative exponents and irrational denominators.

2.1.1 $64^{-\frac{2}{3}}$ (3)

2.1.2 $\dfrac{3^{2n+2}-9^{n-1}}{2.3^{2n+1}}$ (5)

2.1.3 $\dfrac{\left(3-\sqrt{3}\right)^2}{\sqrt{3}.\sqrt{6}}$ (4)

2.2 **Solve for x, without using a calculator:**

2.2.1 $\sqrt[5]{32}=128$ (4)

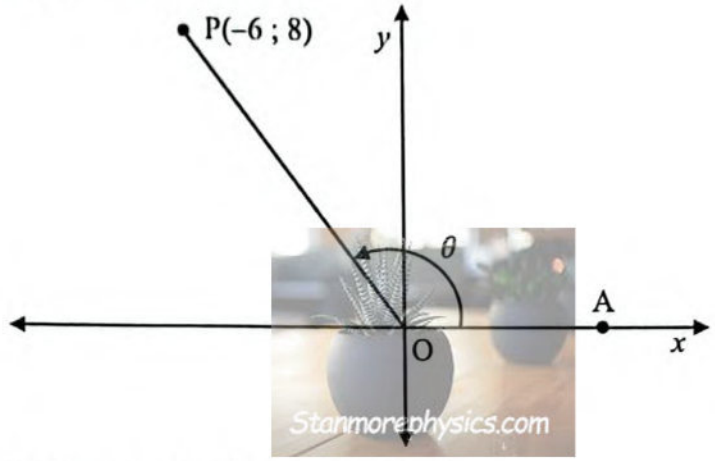
2.2.2 $x^{\frac{1}{2}}-3x^{\frac{1}{4}}-10=0$ (4)

[20]

QUESTION 3

DO NOT USE A CALCULATOR WHEN ANSWERING QUESTION 3.

3.1 In the diagram below, $P(-6\,;\,8)$ is a point in the Cartesian plane. A is a point on the positive x-axis. $A\hat{O}P = \theta$.



Determine, with the aid of the diagram, the following:

3.1.1 The length of OP. (2)

3.1.2 $\sin\theta + \cos\theta$ (3)

3.2 If $\sin 25° = \frac{1}{k}$, determine the value of $\tan 25°$ in terms of k. (3)

3.3 Simplify the following expression fully, without the use of a calculator:

$$\frac{\sin 698°.\cos 300°}{\tan 135°.\cos(-248°)}$$ (7)

[15]

QUESTION 4

4.1 Simplify the following expression fully:

$$\frac{\sin(180^\circ + x).\sin(90^\circ + x)}{\tan(-x)} + \sin x.\cos(90^\circ - x) \quad (7)$$

4.2 Given: $\frac{\sin\theta}{1+\cos\theta}$

4.2.1 Prove that $\frac{\sin\theta}{1+\cos\theta} = \frac{1-\cos\theta}{\sin\theta}$ (3)

4.2.2 For which value of θ in the interval $\theta \in [0^\circ ; 360^\circ]$ is $\frac{\sin\theta}{1+\cos\theta}$ undefined? (2)

[12]

TOTAL: 75

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GRADE 11

MATHEMATICS

COMMON TEST

MARCH 2024

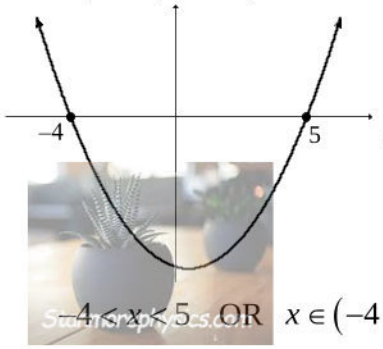
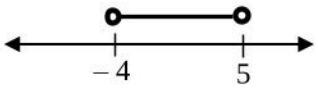
MARKING GUIDELINES

MARKS: 75

These marking guidelines consist of 8 pages.

GRADE 11
Marking Guideline

QUESTION 1

1.1.1	$2x^2+5x=0$ $x(2x+5)=0$ $x=0$ or $x=-\frac{5}{2}$	✓ factors ✓ answer ✓ answer (3)
1.1.2	$-4x^2+3x+6=0$ OR $4x^2-3x-6=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\frac{-3\pm\sqrt{3^2-4(-4)(6)}}{2(-4)}$ $=\frac{3\pm\sqrt{(-3)^2-4(4)(-6)}}{2(4)}$ $=-0,91$ or $x=1,66$	✓ substitution ✓ answer ✓ answer (3)
1.1.3	$3\sqrt{x-2}=x$ $\left(3\sqrt{x-2}\right)^2=x^2$ $9(x-2)=x^2$ $x^2-9x+18=0$ $(x-6)(x-3)=0$ $x=3$ or $x=6$	✓ squaring both sides ✓ standard form ✓ factors ✓ both answers (4)
1.2.1	$x^2-x-20<0$ $(x+4)(x-5)<0$  OR  $-4<x<5$ OR $x\in(-4\,;5)$	✓ factors ✓ ✓ answer (3)
1.2.2	Sum of integers $=(-3)+(-2)+(-1)+0+1+2+3+4$ $=4$	✓ adding integers between –4 and 5 ✓ answer (2)

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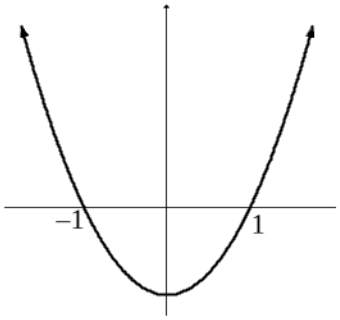
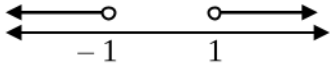
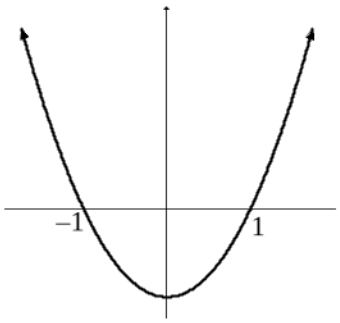
Marking Guideline

1.3	$4x+y=7$ $y=7-4x$ …….…. line 1 $3x^2+2xy=y^2$ ……. line 2 Substitute line 1 into line 2: $3x^2+2x(7-4x)=(7-4x)^2$ $3x^2+14x-8x^2=49-56x+16x^2$ $-21x^2+70x-49=0$ $3x^2-10x+7=0$ $(3x-7)(x-1)=0$ $x=\frac{7}{3}$ or $x=1$ $y=-\frac{7}{3}$ or $y=3$	✓ making y the subject of the formula ✓ substitution ✓ standard form ✓ factors ✓ x-values ✓ y-values (6)
1.4	For equal roots: $13-2k=0$ $2k=13$ $k=\frac{13}{2}$ or $6\frac{1}{2}$	✓ $13-2k=0$ ✓ answer (2)
1.5	$(x+5)^2=1-p^2$ $x+5=\pm\sqrt{1-p^2}$ $x=-5\pm\sqrt{1-p^2}$ For non-real roots: $1-p^2<0$ $\therefore p^2-1>0$  OR  $p<-1$ or $p>1$ OR $p\in(-\infty;-1)$ or $(1;\infty)$ **OR**	✓ square root taken on both sides ✓ x subject of formula ✓ $1-p^2<0$ ✓ ✓ answer (5) **OR**

	$(x+5)^2 = 1-p^2$ $x^2+10x+25 = 1-p^2$ $x^2+10x+24+p^2 = 0$ $b^2-4ac = 10^2-4(1)(24+p^2)$ $= 100-96-4p^2$ $= 4-4p^2$ For non-real roots: $4-4p^2 < 0$ $p^2-1 > 0$ $(p-1)(p+1) > 0$  OR  $p < -1$ or $p > 1$ OR $p \in (-\infty\,;-1)$ or $(1\,;\infty)$	✓ $b^2-4ac = 4-4p^2$ ✓ $4-4p^2 < 0$ ✓ factorisation ✓ ✓ answer (5)
		[28]

QUESTION 2

2.1.1	$64^{-\frac{2}{3}}$ $= \left(2^6\right)^{-\frac{2}{3}}$ $= 2^{-4}$ $= \frac{1}{16}$ **OR** $64^{-\frac{2}{3}}$ $= \left(4^3\right)^{-\frac{2}{3}}$ $= 4^{-2}$ $= \frac{1}{16}$ **OR**	✓ $\left(2^6\right)^{-\frac{2}{3}}$ ✓ 2^{-4} ✓ answer (3) **OR** ✓ $\left(4^3\right)^{-\frac{2}{3}}$ ✓ 4^{-2} ✓ answer (3) **OR**

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Marking Guideline

	$64^{-\frac{2}{3}}$ $=\frac{1}{64^{\frac{2}{3}}}$ $=\frac{1}{\sqrt[3]{64^2}}$ $=\frac{1}{4^2}$ $=\frac{1}{16}$ Answer only: 0 marks	✓ $\frac{1}{64^{\frac{2}{3}}}$ ✓ $\frac{1}{\sqrt[3]{64^2}}$ ✓ answer (3)
2.1.2	$\frac{3^{2n+2}-9^{n-1}}{2.3^{2n+1}}$ $=\frac{3^{2n+2}-\left(3^2\right)^{n-1}}{2.3.3^{2n}}$ $=\frac{3^{2n+2}-3^{2n-2}}{6.3^{2n}}$ $=\frac{3^{2n}\left(3^2-3^{-2}\right)}{6.3^{2n}}$ $=\frac{3^{2n}\left(9-\frac{1}{9}\right)}{6.3^{2n}}$ $=\frac{80}{9}\times\frac{1}{6}$ $=\frac{40}{27}$	✓ $9^{n-1}=3^{2n-2}$ ✓ $2.3^{2n+1}=6.3^{2n}$ ✓ factorising numerator ✓ simplification ✓ answer (5)
2.1.3	$\frac{\left(3-\sqrt{3}\right)^2}{\sqrt{3}.\sqrt{6}}$ $=\frac{9-6\sqrt{3}+3}{\sqrt{3}.\sqrt{6}}$ $=\frac{12-6\sqrt{3}}{\sqrt{3}.\sqrt{6}}$ $=\frac{6\left(2-\sqrt{3}\right)}{\sqrt{3}.\sqrt{6}}$ $=\frac{6\left(2-\sqrt{3}\right)}{\sqrt{3}.\sqrt{6}}\times\frac{\sqrt{6}}{\sqrt{6}}$ $=\frac{\sqrt{6}\left(2-\sqrt{3}\right)}{\sqrt{3}}$ $=\sqrt{2}\left(2-\sqrt{3}\right)$ OR $=2\sqrt{2}-\sqrt{6}$ Answer only: 0 marks	✓ multiplying out numerator ✓ factorising numerator ✓ $\frac{\sqrt{6}\left(2-\sqrt{3}\right)}{\sqrt{3}}$ ✓ answer (4)

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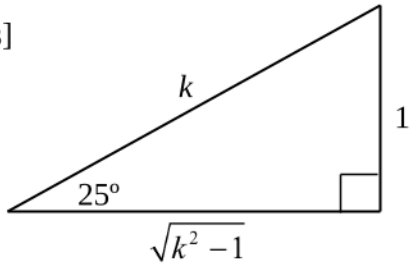
2.2.1	$\sqrt[x]{32}=128$ $32^{\frac{1}{x}}=128$ $\left(2^5\right)^{\frac{1}{x}}=2^7$ $2^{\frac{5}{x}}=2^7$ $\therefore \frac{5}{x}=7$ $x=\frac{5}{7}$	✓ $32^{\frac{1}{x}}$ ✓ $32=2^5$ and $128=2^7$ ✓ equating exponents ✓ answer (4)
2.2.2	$x^{\frac{1}{2}}-3x^{\frac{1}{4}}-10=0$ $\left(x^{\frac{1}{4}}+2\right)\left(x^{\frac{1}{4}}-5\right)=0$ $x^{\frac{1}{4}}\neq -2 \quad \text{or} \quad x^{\frac{1}{4}}=5$ $x=5^4$ $=625$ $x=-1$ **OR** $x^{\frac{1}{2}}-3x^{\frac{1}{4}}-10=0$ Let $k=x^{\frac{1}{4}}$: $k^2-3k-10=0$ $(k+2)(k-5)=0$ $k\neq -2 \quad \text{or} \quad k=5$ $\therefore x^{\frac{1}{4}}\neq -2 \quad \text{or} \quad x^{\frac{1}{4}}=5$ $x=5^4$ $=625$	✓✓ one mark for each correct factor ✓ $x^{\frac{1}{4}}\neq -2$ ✓ answer (4) **OR** ✓✓ one mark for each correct factor ✓ $x^{\frac{1}{4}}\neq -2$ ✓ answer (4)
		[20]

GRADE 11
Marking Guideline

QUESTION 3

3.1.1	$OP^2 = (-6)^2 + 8^2$ $= 100$ $\therefore OP = 10$	✓ substitution in $r^2 = x^2 + y^2$ ✓ answer (2)
3.1.2	$\sin\theta + \cos\theta$ $= \frac{8}{10} + \frac{(-6)}{10}$ $= \frac{2}{10} = \frac{1}{5}$	✓ $\frac{8}{10}$ ✓ $\frac{-6}{10}$ ✓ answer (3)
3.2	$x^2 = r^2 - y^2$ [Pythagoras] $= k^2 - 1$ $x = \sqrt{k^2 - 1}$ $\tan 25^\circ = \frac{1}{\sqrt{k^2 - 1}}$ 	✓ substitution in Pythagoras or sketch ✓ $\sqrt{k^2 - 1}$ ✓ answer (3)
3.3	$\frac{\sin 698^\circ . \cos 300^\circ}{\tan 135^\circ . \cos(-248^\circ)}$ $= \frac{-\sin 22^\circ . \cos 60^\circ}{-\tan 45^\circ . -\cos 68^\circ}$ $= \frac{-\sin 22^\circ . \frac{1}{2}}{-1 . -\sin 22^\circ}$ OR $= \frac{-\cos 68^\circ . \frac{1}{2}}{-1 . -\cos 68^\circ}$ $= -\frac{1}{2}$	✓ $-\sin 22^\circ$ ✓ $\cos 60^\circ$ ✓ $-\tan 45^\circ$ ✓ $-\cos 68^\circ$ ✓ special angle values ✓ $\cos 68^\circ = \sin 22^\circ$ or vice versa ✓ answer (7)
		[15]

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QUESTION 4

4.1	$\frac{\sin(180^\circ + x).\sin(90^\circ + x)}{\tan(-x)} + \sin x.\cos(90^\circ - x)$ $= \frac{-\sin x.\cos x}{-\tan x} + \sin x.\sin x$ $= \frac{\sin x.\cos x}{\frac{\sin x}{\cos x}} + \sin x.\sin x$ $= \frac{\sin x.\cos x}{1} \times \frac{\cos x}{\sin x} + \sin x.\sin x$ $= \cos^2 x + \sin^2 x$ $= 1$	✓ $\sin(180^\circ + x) = -\sin x$ ✓ $\sin(90^\circ + x) = \cos x$ ✓ $\tan(-x) = -\tan x$ ✓ $\cos(90^\circ - x) = \sin x$ ✓ $\tan x = \frac{\sin x}{\cos x}$ ✓ simplification ✓ answer (7)
4.2.1	$\frac{\sin\theta}{1+\cos\theta}$ $= \frac{\sin\theta}{1+\cos\theta} \times \frac{(1-\cos\theta)}{(1-\cos\theta)}$ $= \frac{\sin\theta(1-\cos\theta)}{(1+\cos\theta)(1-\cos\theta)}$ $= \frac{\sin\theta(1-\cos\theta)}{1-\cos^2\theta}$ $= \frac{\sin\theta(1-\cos\theta)}{\sin^2\theta}$ $= \frac{1-\cos\theta}{\sin\theta}$	✓ $\times \frac{(1-\cos\theta)}{(1-\cos\theta)}$ ✓ $1-\cos^2\theta$ in denominator ✓ $1-\cos^2\theta = \sin^2\theta$ (3)
4.2.2	Undefined when $1+\cos\theta = 0$ $\cos\theta = -1$ $\therefore \theta = 180^\circ$	✓ $\cos\theta = -1$ ✓ answer (2)
		[12]

TOTAL: 75