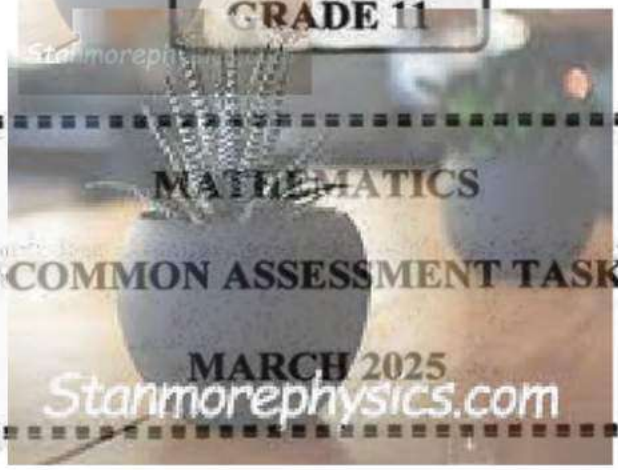
KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11



MATHEMATICS

COMMON ASSESSMENT TASK

MARCH 2025

MARKS: 75

TIME: 1½ hours

This question paper consists of 5 pages.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 3 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. that 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 $x^2 - 3x - 28 = 0$ (3)

1.1.2 $6\left(1+\frac{2}{3}x\right) = 3x^2$ (answer correct to TWO decimal places) (4)

1.1.3 $2x^2 + x - 3 \geq 0$ (4)

1.2 Given: $\sqrt{x-3} = \frac{2}{\sqrt{x}}$

1.2.1 Solve for x. (5)

1.2.2 Hence, or otherwise, solve for k if $\sqrt{k-20} = \frac{2}{\sqrt{k-17}}$. (2)

1.3 Solve simultaneously for x and y:

$2x - y = 3$ and $x^2 - 15 = -5xy - y^2$. (6)

1.4 An equation is given as $\frac{1}{2}x^2 + mx + 18 = 0$

1.4.1 Solve for x in terms of m. (2)

1.4.2 Hence, or otherwise, determine the value(s) of m for which the above equation will have equal roots. (3)

[29]

QUESTION 2

2.1 Evaluate the following expressions, **without using a calculator:**

2.1.1 $\dfrac{\sqrt{121x^2}-\sqrt[3]{27x^3}}{-4^0 x}$ (3)

2.1.2 $\dfrac{8^k.6^{k-3}.9^{1-k}}{16^{k-1}.3^{-k}}$ (4)

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

2.2.1 $2x^{-\frac{1}{3}}=3$ (3)

2.2.2 $(5^x-125)(5^x+1)=0$ (3)

2.3 It is given that $4^m=6$ and $6^n=8$. Calculate the value of mn. (3)

[16]

QUESTION 3

3.1 Given that $13\cos\beta = 5$ and $\alpha + \beta = 90°$. By making use of a sketch and WITHOUT the use of a calculator, calculate the value of $\dfrac{\tan\beta}{\cos\alpha}$. (5)

3.2 Simplify the following to a single trigonometric term:
$\sin(180° + x).\cos^2(90° - x) + \sin(-x).\cos^2(180° - x)$. (6)

3.3 Evaluate WITHOUT the use of a calculator:
$\dfrac{\cos 100°\cos 315°\tan 210°}{\sin 675°\cos 150°\sin 170°}$. (6)

3.4 Given: $(1-\cos^2 x)\left(\tan x + \dfrac{\cos x}{\sin x}\right)$.

3.4.1 Prove that $(1-\cos^2 x)\left(\tan x + \dfrac{\cos x}{\sin x}\right) = \tan x$ (4)

3.4.2 For which value(s) of x in the interval $[0°;360°)$ is the identity in QUESTION 3.4.1 undefined? (3)

3.5 Given that $\sin\theta = \dfrac{-6k}{k^2+9}$ and $\theta \in (90° ; 270°)$. If $0 < k < 3$, determine the value of $\tan\theta + \dfrac{1}{\cos\theta}$ in terms of k. Your answer must be a single fraction in its simplest form. (5)

[30]

FINAL

KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

MATHEMATICS

ASSESSMENT TASK

MARCH 2025

MARKING GUIDELINES

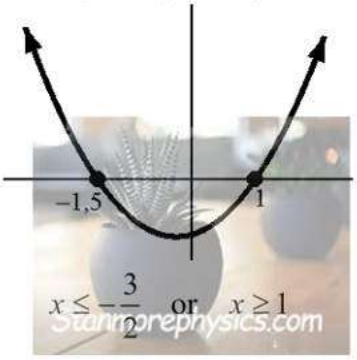
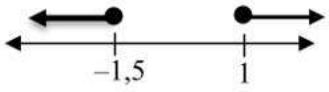
NATIONAL SENIOR CERTIFICATE

GRADE 11

MARKS: 75

These marking guidelines consist of 7 pages.

QUESTION 1

1.1.1	$x^2-3x-28=0$ $(x+4)(x-7)=0$ **OR** $x=\frac{-(-3)\pm\sqrt{(-3)^2-4(1)(-28)}}{2(1)}$ $x=-4$ or $x=7$	✓A correct factors **OR** subst. into correct formula ✓CA answer ✓CA answer (3)
1.1.2	$6\left(1+\frac{2}{3}x\right)=3x^2$ $6+4x=3x^2$ $3x^2-4x-6=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\frac{-(-4)\pm\sqrt{(-4)^2-4(3)(-6)}}{2(3)}$ $x=-0,90$ or $x=2,23$ **OR** $\frac{1}{2}x^2-\frac{2}{3}x-1=0$ $x=\frac{-\left(-\frac{2}{3}\right)\pm\sqrt{\left(-\frac{2}{3}\right)^2-4\left(\frac{1}{2}\right)(-1)}}{2\left(\frac{1}{2}\right)}$ $x=-0,90$ or $x=2,23$ **NOTE: Penalty of 1 mark for incorrect rounding.**	✓A standard form ✓CA subst. into correct quadratic formula CA✓ answer ✓CA answer. (4)
1.1.3	$2x^2+x-3\geq 0$ $(2x+3)(x-1)\geq 0$  $x\leq -\frac{3}{2}$ or $x\geq 1$ **OR**  **OR** $x\in\left(-\infty;-\frac{3}{2}\right]\cup[1;\infty)$	✓A correct factors ✓CA critical values (can be on a sketch or number line) ✓CA✓CA answer (4)
1.2.1	$\sqrt{x-3}=\frac{2}{\sqrt{x}}$ $\sqrt{x}.\sqrt{x-3}=2$ $\sqrt{x(x-3)}=2$ $x(x-3)=2^2$ $x^2-3x-4=0$ $(x-4)(x+1)=0$ $x=4$ or $x\neq -1$ **OR** $\sqrt{x-3}=\frac{\sqrt{4}}{\sqrt{x}}$ $\sqrt{x-3}=\sqrt{\frac{4}{x}}$ $x-3=\frac{4}{x}$ $x^2-3x-4=0$ $(x-4)(x+1)=0$ $x=4$ or $x\neq -1$	✓A squaring both sides ✓A standard form ✓CA factors ✓CA ✓CA both answers with rejection (5)

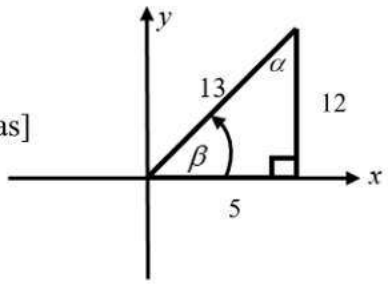
1.2.2	$\sqrt{k-20}=\dfrac{2}{\sqrt{k-17}}$ $k-17=4$ $k=21$	✓CA equating $k-17$ to value of x ✓CA answer (2)
1.3	$y=2x-3$ $x^2-15=-5x(2x-3)-(2x-3)^2$ $x^2-15=-10x^2+15x-(4x^2-12x+9)$ $x^2-15=-10x^2+15x-4x^2+12x-9$ $x^2+10x^2+4x^2-15x-12x-15+9=0$ $15x^2-27x-6=0$ $5x^2-9x-2=0$ $(5x+1)(x-2)=0$ $x=-\dfrac{1}{5}$ or $x=2$ $y=2\left(-\dfrac{1}{5}\right)-3$ or $y=2(2)-3$ $y=-\dfrac{17}{5}$ or $y=1$ **OR** $x=\dfrac{y+3}{2}$ $\left(\dfrac{y+3}{2}\right)^2-15=-5y\left(\dfrac{y+3}{2}\right)-y^2$ $\dfrac{y^2+6y+9}{4}-15=\dfrac{-5y^2-15y}{2}-y^2$ $4\left(\dfrac{y^2+6y+9}{4}\right)-4(15)=4\left(\dfrac{-5y^2-15y}{2}\right)-4(y^2)$ $y^2+6y+9-60=-10y^2-30y-4y^2$ $15y^2+36y-51=0$ $5y^2+12y-17=0$ $(5y+17)(y-1)=0$ $y=-\dfrac{17}{5}$ or $y=1$ $x=\dfrac{\left(-\frac{17}{5}\right)+3}{2}$ or $x=\dfrac{(1)+3}{2}$ $x=-\dfrac{1}{5}$ or $x=2$	✓A $y=2x-3$ ✓CA substitution ✓CA simplification ✓CA factors ✓CA both $x-$values ✓CA both $y-$values (6) **OR** ✓A $x=\dfrac{y+3}{2}$ ✓CA substitution ✓CA simplification ✓CA factors ✓CA both $y-$values ✓CA both $x-$values (6)

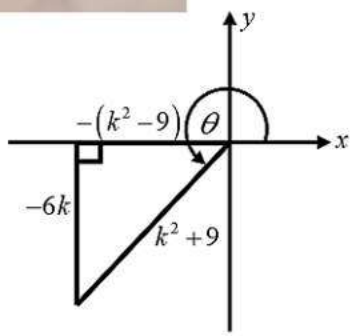
1.4.1	$\frac{1}{2}x^2+mx+18=0$ $x=\frac{-m\pm\sqrt{(m)^2-4\left(\frac{1}{2}\right)(18)}}{2\left(\frac{1}{2}\right)}$ $x=-m\pm\sqrt{m^2-36}$	**OR** $x^2+2mx+36=0$ $x=\frac{-2m\pm\sqrt{(2m)^2-4(1)(36)}}{2(1)}$ $x=\frac{-2m\pm\sqrt{4m^2-144}}{2}$	✓A correct substitution into quadratic formula ✓CA simplified answer (2)
1.4.2	$\Delta=m^2-36$ $b^2-4ac=0$ $\therefore m^2-36=0$ $(m+6)(m-6)=0$ $m=-6$ or $m=6$	**OR** $\Delta=4m^2-144$ $b^2-4ac=0$ $\therefore 4m^2-144=0$ $(2m+12)(2m-12)=0$ $m=-6$ or $m=6$	✓CA Δ equated to 0 ✓CA factors ✓CA both answers (3)
	NOTE: Penalise a mark if $\pm$ is NOT shown in factors $m=\pm\sqrt{36}$		
			[29]

QUESTION 2

2.1.1	$\frac{\sqrt{121x^2}-\sqrt[3]{27x^3}}{-4^0x}$ $=\frac{11x-3x}{-1x}$ $=-8$	✓A numerator: square & cube ✓A denominator ✓CA answer (3)
2.1.2	$\frac{8^k.6^{k-3}.9^{1-k}}{16^{k-1}.3^{-k}}$ $=\frac{\left(2^3\right)^k.(2.3)^{k-3}.\left(3^2\right)^{1-k}}{\left(2^4\right)^{k-1}.3^{-k}}$ $=\frac{2^{3k}.2^{k-3}.3^{k-3}.3^{2-2k}}{2^{4k-4}.3^{-k}}$ $=2^{3k+k-3-4k+4}.3^{k-3+2-2k+k}$ $=2^1.3^{-1}$ $=\frac{2}{3}$	✓A splitting to prime bases ✓CA applying the exponential laws correctly ✓CA simplification ✓CA answer (4)
2.2.1	$2x^{-\frac{1}{3}}=3$ $x^{-\frac{1}{3}}=\frac{3}{2}$ $\left(x^{-\frac{1}{3}}\right)^{-3}=\left(\frac{3}{2}\right)^{-3}$ $x=\left(\frac{2}{3}\right)^3$ $x=\frac{8}{27}$	✓A isolating the variable ✓A raising both sides of equation to an exponent of –3 ✓CA answer (3)
2.2.2	$(5^x-125)(5^x+1)=0$ $5^x=125$ or $5^x=-1$ $5^x=5^3$ no solution $x=3$	✓A both equations after transposing ✓A $5^x=5^3$ and no solution ✓A answer (3)
2.3	$4^m=6$ $4^{mn}=6^n$ $4^{mn}=8$ $2^{2mn}=2^3$ $2mn=3$ $mn=\frac{3}{2}$	✓A raising both sides to exponent n ✓A substituting 8 for 6^n ✓A answer (3)
		[16]

QUESTION 3

3.1	$13\cos\beta = 5$ $\cos\beta = \frac{5}{13}$ $y^2 = r^2 - x^2$ [Pythagoras] $= 13^2 - 5^2$ $y = 12$  $\frac{\tan\beta}{\cos\alpha} = \frac{\frac{12}{5}}{\frac{12}{13}}$ $= \frac{12}{5} \times \frac{13}{12}$ $= \frac{13}{5}$ or $2\frac{3}{5}$	✓A diagram ✓ A y – value ✓CA correct substitution for $\tan\beta$ ✓CA correct substitution for $\cos\alpha$ ✓CA answer (5)
3.2	$\sin(180° + x).\cos^2(90° - x) + \sin(-x).\cos^2(180° - x)$ $= (-\sin x)(\sin x)^2 + (-\sin x)(-\cos x)^2$ $= -\sin x(\sin^2 x + \cos^2 x)$ $= -\sin x(1)$ $= -\sin x$	✓A $-\sin x$ ✓A $\sin^2 x$ ✓A $-\sin x$ ✓A $(-\cos x)^2$ ✓CA factors ✓CA answer (6)
3.3	$\frac{\cos 100° \cos 315° \tan 210°}{\sin 675° \cos 150° \sin 170°}$ $= \frac{(-\cos 80°)(\cos 45°)(\tan 30°)}{(-\sin 45°)(-\cos 30°)(\sin 10°)}$ $= -\frac{\sin 10° \times \frac{\sqrt{2}}{2} \times \frac{1}{\sqrt{3}}}{\frac{\sqrt{2}}{2} \times \frac{\sqrt{3}}{2} \times \sin 10°}$ $= -\frac{1}{\sqrt{3}} \times \frac{2}{\sqrt{3}}$ $= -\frac{2}{3}$	✓A numerator ✓A denominator ✓ A $\cos 80° = \sin 10°$ **OR** $\sin 10° = \cos 80°$ ✓ CA special angle values ✓CA simplification ✓CA answer (6)

3.4.1	$\text{LHS} = \left(1-\cos^2 x\right)\left(\tan x + \frac{\cos x}{\sin x}\right)$ $= \sin^2 x\left(\frac{\sin x}{\cos x} + \frac{\cos x}{\sin x}\right)$ $= \sin^2 x\left(\frac{\sin^2 x + \cos^2 x}{\cos x.\sin x}\right)$ $= \sin^2 x\left(\frac{1}{\cos x.\sin x}\right)$ $= \frac{\sin x}{\cos x}$ $= \tan x$ $= \text{RHS}$ **Please Note:** **This question is out of 4 marks in the question paper. It should be out of 5 marks as in the memo.**	✓A $\sin^2 x$ ✓A $\frac{\sin x}{\cos x}$ ✓A LCD $(\cos x.\sin x)$ ✓A $\sin^2 x + \cos^2 x = 1$ ✓A simplification to $\frac{\sin x}{\cos x}$ (5)
3.4.2	Undefined when $\sin x = 0$ and $\tan x$ is undefined $\therefore x \in \{0° ; 90° ; 180° ; 270°\}$	A✓A✓A✓ (Any 3 values given) (3)
3.5	$x^2 = r^2 - y^2$ [Pythagoras] $= \left(k^2+9\right)^2 - \left(-6k\right)^2$ $= k^4 + 18k^2 + 81 - 36k^2$ $= k^4 - 18k^2 + 81$ $= \left(k^2-9\right)^2$ $x = \pm\left(k^2-9\right)$ $\therefore x = -\left(k^2-9\right)$  $\tan\theta + \frac{1}{\cos\theta} = \frac{-6k}{-\left(k^2-9\right)} + \frac{1}{\frac{-\left(k^2-9\right)}{k^2+9}}$ $= \frac{6k}{\left(k^2-9\right)} - \frac{k^2+9}{\left(k^2-9\right)}$ $= \frac{6k-k^2-9}{k^2-9}$ $= \frac{-\left(k^2-6k+9\right)}{k^2-9}$ $= -\frac{(k-3)(k-3)}{(k-3)(k+3)}$ $= -\frac{(k-3)}{(k+3)}$	✓A diagram in quadrant 3 ✓A x – value ✓CA correct substitution ✓CA simplification to a single fraction ✓CA answer (5)
		[30]

TOTAL: 75