

education

Department:
Education
PROVINCE OF KWAZULU-NATAL

NATIONAL SENIOR CERTIFICATE

GRADE 11

MATHEMATICS PAPER 1

COMMON TEST

AMAJUBA DISTRICT

JULY 2021

MARKS: 75

TIME: 1½ hours

This question paper consists of 5 pages, including the cover page and instructions.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

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

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QUESTION 1

1.1 Solve for x:

1.1.1 $\frac{1}{2}x(3-x)=0$ (2)

1.1.2 $5x^2 = 3x + 4$ (correct to two decimal places) (4)

1.1.3 $x-\sqrt{2x-1}=2$ (4)



1.1.4 $x^2 \le 15+2x$ (3)

1.2 Solve for x and y simultaneously: $2x-y=7$ and $x^2+xy+y^2=21$. (6)

1.3 Given that $G=\frac{\sqrt{2x+7}}{x-5}$

For which values of x will G be a real number? (3)

[22]

QUESTION 2

2.1 Solve for x without the use of a calculator : $\frac{4^{3x-1}}{8^x}=2^{2-x}$ (3)

2.2 If $\frac{9^{x+1}-6.3^{2x}}{(\sqrt{3})^{4x+1}}=3^a$, determine the value of a. (3)

2.3 Solve for x if $3^x-8=3^{2-x}$ (4)

[10]

QUESTION 3

3.1 Which term of the sequence $23\ ;\ 21\ ;19\ ;$ ... will be equal to -47? (4)

3.2 Consider the following quadratic number pattern: $1\ ;\ 4\ ;\ 11\ ;\ 22\ ;\ 37\ ;\ \ldots$

3.2.1 Determine the formula for the general term (T_n) of this pattern. (4)

3.2.2 Determine the value of the 20th term of the first difference sequence for this quadratic number pattern. (3)

3.3 In the quadratic number pattern $4\ ;x\ ;y\ ;\ -11\ ;$ ... the first three first differences between terms are $2p-4;\ p-3$ and $\frac{p}{2}-1$.

Determine:

3.2.1 the value of p. (3)

3.2.2 the second difference. (2)



3.2.3 the values of x and y. (2)

3.4 Given the number pattern: $2\ ;\ 4\ ;\ 8\ ;\ 16\ \ldots$

3.4.1 Is this pattern linear, quadratic or exponential? (1)

3.4.2 Write down the general term (T_n) of this pattern. (1)

[20]

QUESTION 4

Given: $g(x)=\dfrac{-3}{x-2}+6$

4.1 Determine the intercepts of g with the axes. (4)

4.2 Write down the equations of the asymptotes of g. (2)

4.3 Draw the graph of g on your answer sheet. Show clearly the intercepts with the axes as well as the asymptotes. (3)

4.4 Write down the range of h if $h(x)=-g(x)$. (1)

4.5 Determine the equation of the axis of symmetry of g that has a negative x-intercept. (2)

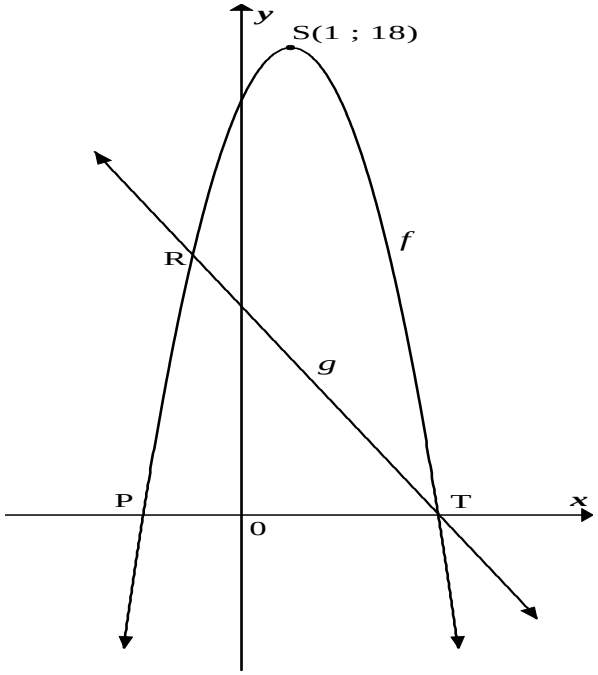
[12]

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QUESTION 5

S(1 ; 18) is the turning point of the graph of $f(x) = ax^2 + bx + c$.
P and T are the x-intercepts of f.
The graph of $g(x) = -2x + 8$ has an x-intercept at T.
R is a point of intersection of f and g.





5.1 Calculate the coordinates of T. (2)

5.2 Determine the equation of f in the form $y = a(x + p)^2 + q$. (4)

5.3 If the coordinates of R are (−1 ; 10), use the graphs to determine for which values of x:

5.3.1 $f(x) > g(x)$ (2)

5.3.2 $f(x).g(x) < 0$ (3)

[11]

TOTAL: 75

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MATHEMATICS PAPER 1 MARKING GUIDELINE

AMAJUBA DISTRICT COMMON TEST

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MARKING GUIDELINE

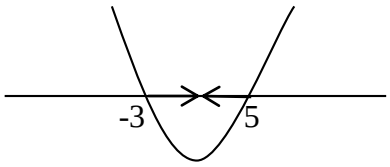
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GRADE 11

MARKS: **75**

These marking guidelines consist of 7 pages.

QUESTION 1

1.1.1	$\frac{1}{2}x(3-x)=0$ $x = 0$ or $x = 3$	✓ $x=0$ $x = 3$✓ (2)
1.1.2	$5x^2 = 3x + 4$ $5x^2 - 3x - 4 = 0$ $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$ $x = \frac{-(-3) \pm \sqrt{(-3)^2-4(5)(-4)}}{2(5)}$ $x = -0{,}64$ or $1{,}24$	✓standard form ✓ substitution into quadratic formula ✓ answer ✓answer (4)
1.1.3	$x - \sqrt{2x-1} = 2$ $x - 2 = \sqrt{2x-1}$ $(x-2)^2 = (\sqrt{2x-1})^2$ $x^2 - 4x + 4 = 2x - 1$ $x^2 - 6x + 5 = 0$ $(x-5)(x-1) = 0$ $x = 5$ or $x \neq 1$	✓ isolate surd ✓ square both sides ✓ standard form ✓ answer and rejecting $x = 1$ (4)
1.1.4	$x^2 \leq 15 + 2x$ $x^2 - 2x - 15 \leq 0$ $(x+3)(x-5) \leq 0$  $-3 \leq x \leq 5$	✓ factors ✓method ✓ answer (3)
1.2	$y = 2x - 7$ $x^2 + x(2x-7) + (2x-7)^2 = 21$ $7x^2 - 35x + 28 = 0$ $x^2 - 5x + 4 = 0$ $(x-4)(x-1) = 0$ $x = 4$ or $x = 1$ $y = 1$ or $y = -5$	✓ $y = 2x - 7$ ✓ substitution ✓ standard form ✓factors ✓x values ✓ y values (6)
1.3	$2x + 7 \geq 0$ $x \geq \frac{-7}{2}$ or $x \neq 5$	✓ $2x + 7 \geq 0$ ✓ $x \geq \frac{-7}{2}$ ✓ $x \neq 5$ (3)
		[22]

QUESTION 2

2.1	$\frac{4^{3x-1}}{8^x} = 2^{2-x}$ $\frac{2^{2(3x-1)}}{2^{3x}} = 2^{2-x}$ $2^{6x-2-3x} = 2^{2-x}$ $3x-2 = 2-x$ $4x = 4$ $x = 1$	✓writing in terms of base 2 ✓ equating exponents ✓answer (3)
2.2	$\frac{9^{x+1}-6.3^{2x}}{(\sqrt{3})^{4x+1}} = 3^a$ $L.H.S = \frac{3^{2(x+1)}-6.3^{2x}}{3^{\frac{1}{2}(4x+1)}}$ $= \frac{3^{2x}.3^2-6.3^{2x}}{3^{2x}.3^{\frac{1}{2}}}$ $= \frac{3^{2x}(3^2-6)}{3^{2x}.3^{\frac{1}{2}}}$ $= \frac{3}{3^{\frac{1}{2}}}$ $= 3^{\frac{1}{2}}$ $\therefore a = \frac{1}{2}$	✓ writing in terms of the base 3 ✓ common factor ✓ $a = \frac{1}{2}$ (3)
2.3	$3^x - 8 = 3^{2-x}$ $3^x - 8 = 3^2.3^{-x}$ $3^x - 8 = \frac{3^2}{3^x}$ $3^{2x} - 8.3^x = 3^2$ $3^{2x} - 8.3^x - 9 = 0$ $(3^x - 9)(3^x + 1) = 0$ OR Let $3^x = k$ $\therefore k^2 - 8k - 9 = 0$ $(k-9)(k+1) = 0$ $k = 9$ or $k = -1$ $\therefore 3^x = 3^2$ or $3^x = -1$ $x = 2$ or no solution	✓ $\frac{3}{3^x}$ ✓ $3^{2x} - 8.3^x - 9 = 0$ or $k^2 - 8k - 9 = 0$ ✓ factors ✓ $x = 2$ only (4)
		[10]

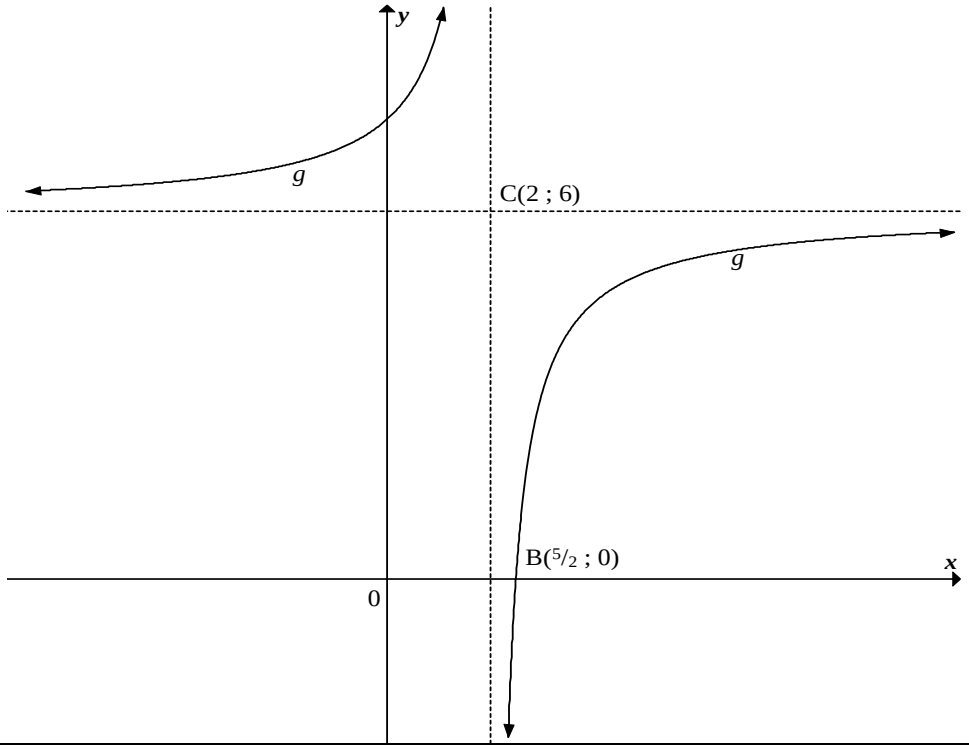
QUESTION 3

3.1	$T_n = bn + c$ $b = -2$ $23 = -2(1) + c$ $25 = c$ $T_n = -2n + 25$ $-47 = -2n + 25$ $-72 = -2n$ $n = 36$ $T_{36} = -47$	✓ $-2n$ ✓ $+25$ ✓ $n = 36$ ✓ $T_n = -47$ (4)
3.2.1	1 4 11 22 3 7 11 4 4 $2a = 4$ $a = 2$ $3a + b = 3$ $3(2) + b = 3$ $b = -3$ $a + b + c = 1$ $2 - 3 + c = 1$ $c = 2$ $\therefore T_n = 2n^2 - 3n + 2$	✓ $a = 2$ ✓ $b = -3$ ✓ $c = 2$ ✓ $T_n = 2n^2 - 3n + 2$ (4)
3.2.2	3 7 11 4 4 $T_n = 4n - 1$ $T_{20} = 4(20) - 1$ $T_{20} = 79$	✓ $T_n = 4n - 1$ ✓ substitution ✓ answer (3)

3.3.1	$p-3-(2p-4)=\frac{p}{2}-1-(p-3)$ $2(p-3)=2p-4+\frac{p}{2}-1$ $p=-2$	✓ $p-3-(2p-4)$ ✓ equating to $\frac{p}{2}-1-(p-3)$ ✓$p=-2$ (3)
3.3.2	$p-3-(2p-4)$ OR $\frac{p}{2}-1-(p-3)$ $=p-3-2p+4$ $=\frac{p}{2}-1-p+3$ $=-p+1$ $=-\frac{p}{2}+2$ $=-(-2)+1$ $=-\frac{(-2)}{2}+2$ $=3$ $=3$	✓substitution ✓answer (2)
3.3.3	$x-4=2p-4$ $x-4=2(-2)-4$ $x=-4$ $y-x=p-3$ $y-(-4)=-2-3$ $y=-9$	✓ x value ✓ y value (2)
3.4.1	exponential	✓ answer (1)
3.4.2	$2^1;2^2;2^3;2^4$ $T_n=2^n$	✓ answer (1)
		[20]

QUESTION 4

4.1	Substitute $y = 0$: $0=\frac{-3}{x-2}+6$ $-6=\frac{-3}{x-2}$ $-6x+12=-3$ $x=\frac{15}{6}=\frac{5}{2}$ Substitute $x = 0$: $y=\frac{-3}{0-2}+6$ $y=\frac{15}{2}=7,5$	✓ $0=\frac{-3}{x-2}+6$ ✓ $x=\frac{5}{2}$ ✓ $y=\frac{-3}{0-2}+6$ ✓ $y=\frac{15}{2}=7,5$ (4)
4.2	$x=2$ $y=6$	✓ $x=2$ ✓ $y=6$ (2)

4.3		✓ horizontal asymptote and vertical asymptote ✓ shape ✓intercepts with the axes (3)
4.4	$h(x) = -g(x) = -\left(\frac{-3}{x-2}+6\right)$ $= \frac{3}{x-2} - 6$ Reflection in the x-axis $\therefore y \in \Re, y \neq -6$	✓answer (1)
4.5	Can see from the graph that it will be the asymptote with the positive gradient. Therefore the equation can be written as: $y = x + c$ Substitute the point of intersection of the asymptotes (2 ; 6): $6 = 2 + c$ $4 = c$ $\therefore y = x + 4$	✓ substitute the point (2;6) in $y = x + c$ ✓ answer (2)
		[12]

QUESTION 5

5.1	$0=-2x+8$ $\therefore x=4$ $T(4;0)$	✓ $0=-2x+8$ ✓ $x=4$ (2)
5.2	$f(x)=a(x+p)^2+q$ Subst. $p=-1$ *and* $q=18$: $f(x)=a(x-1)^2+18$ Substitute (4 ; 0): $0=a(4-1)^2+18$ $-18=9a$ $\therefore a=-2$ The equation of f: $f(x)=-2(x-1)^2+18$	✓ $f(x)=a(x-1)^2+18$ ✓ $0=a(4-1)^2+18$ ✓ $a=-2$ ✓ $y=-2(x-1)^2+18$ (4)
5.3.1	$x\in(-1;4)$ OR $-1<x<4$	✓✓ answer (2)
5.3.2	$x=\frac{x_1+x_2}{2}$ $1=\frac{x_1+4}{2}$ $\therefore x_1=-2$ $P(-2;0)$ Answer: $x<-2$	✓ method ✓ $x_1=-2$ ✓ $x<-2$/answer (3)
		[11]

TOTAL: 75

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