Education
KwaZulu-Natal Department of
REPUBLIC OF SOUTH AFRICA

MATHEMATICS P1

COMMON TEST

JUNE 2017

NATIONAL SENIOR CERTIFICATE

GRADE 11

MARKS: 100

TIME: 2 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 6 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, et cetera 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 to TWO decimal places, unless stated otherwise.
8. Diagrams are NOT necessarily drawn to scale.
9. Write neatly and legibly.

QUESTION 1

1.1 Solve for x:

1.1.1 $(x+3)(x-5)=9$ (3)

1.1.2 $x-\sqrt{2x-1}=2$ (4)

1.1.3 $1<(2x-3)^2$ (5)

1.2 Given: $3x^2 = 3x + 5$

1.2.1 Solve for x (correct to TWO decimal places). (4)

1.2.2 Hence, or otherwise, solve for y if $3(y+1)^2 = 3(y+1) + 5$. (2)

1.3 Describe the nature of the roots of $3x^2 = 3x + 5$ (2)

1.4 Solve for x and y in the following simultaneous equations:
$2x+y=1$ and $2x^2-xy+y^2=4$ (6)

[26]

QUESTION 2

2.1 Solve for x, without the use of a calculator:

2.1.1 $\dfrac{\sqrt{75}-\sqrt{12}}{x}=\sqrt{48}$ (4)

2.1.2 $5x^{\frac{3}{2}}-256=\sqrt{x^3}$ (4)

2.2 Simplify without the use of a calculator:

2.2.1 $\left(\dfrac{1}{\sqrt{2}}+\sqrt{2}\right)^2$ (2)

2.2.2 $\sqrt[m]{\dfrac{6^m+5(3^m)}{10^m+5^{m+1}}}$ (4)

[14]

QUESTION 3

3.1 4; 10; 18; 28; ..... is a quadratic number pattern.

3.1.1 Write down the next term in the pattern. (1)

3.1.2 Determine an expression for the n^{th} term of the pattern. (4)

3.1.3 Calculate the value of the first term of the pattern that will be greater than 460. (4)

3.1.4 Determine an expression for the n^{th} term of the sequence of first differences of this quadratic number pattern. (2)

3.1.5 Between which two terms of the quadratic number pattern will the first difference be equal to 64? (3)

3.2 The first 4 terms of a quadratic sequence are $13\ ;\ x\ ;\ 29\ ;\ x+24\ ;\ .....$
Calculate the value of x. (5)

[19]

QUESTION 4

Given: $h(x)=2^{-x}+1$

4.1 Determine the y-intercept of h. (2)

4.2 Write down the equation of the asymptote. (1)

4.3 Draw a sketch graph of h. Show clearly any intercepts with the axes and the asymptote. (3)

4.4 Determine the average gradient of h between $x=-2$ and $x=0$. (3)

4.5 Solve for x if $h(x)>5$. (2)

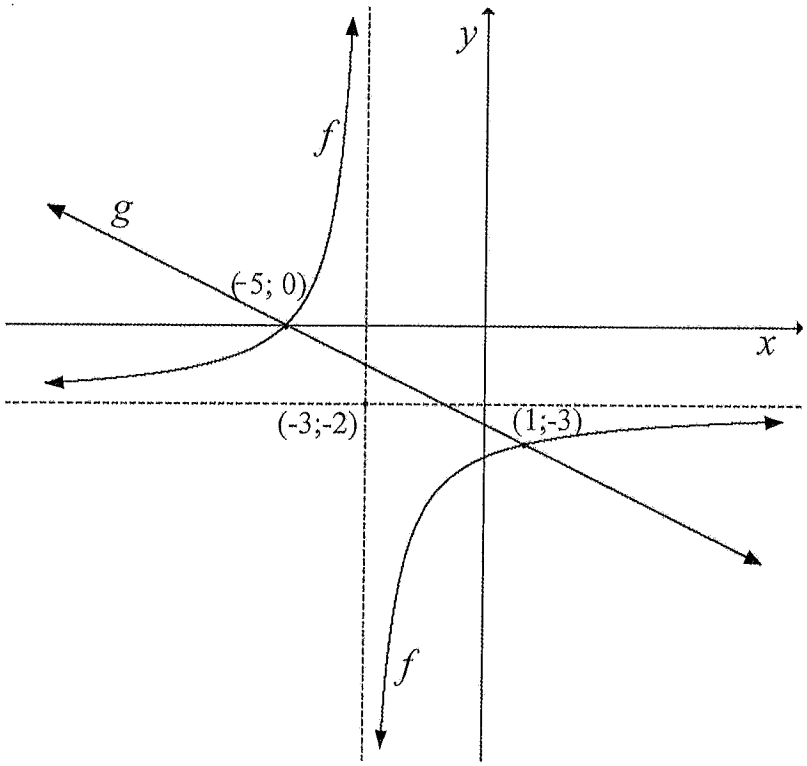
[11]

QUESTION 5

The graphs of $f(x)=\frac{a}{x+p}+q$ and the straight line g are sketched below.

The asymptotes of f intersect at $(-3;-2)$.

The points of intersection of f and g are $(-5;0)$ and $(1;-3)$.



5.1 Determine the values of p, q and a. (4)

5.2 Write down the domain of f. (2)

5.3 The equation of one of the axes of symmetry of f is $y=x+k$.
Calculate the value of k. (2)

5.4 Use the graphs to solve for x, if $f(x)\geq g(x)$. (3)

5.5 Determine the equation of g. (2)

[13]

QUESTION 6

The sketch below represents the graphs of two parabolas: f and g.

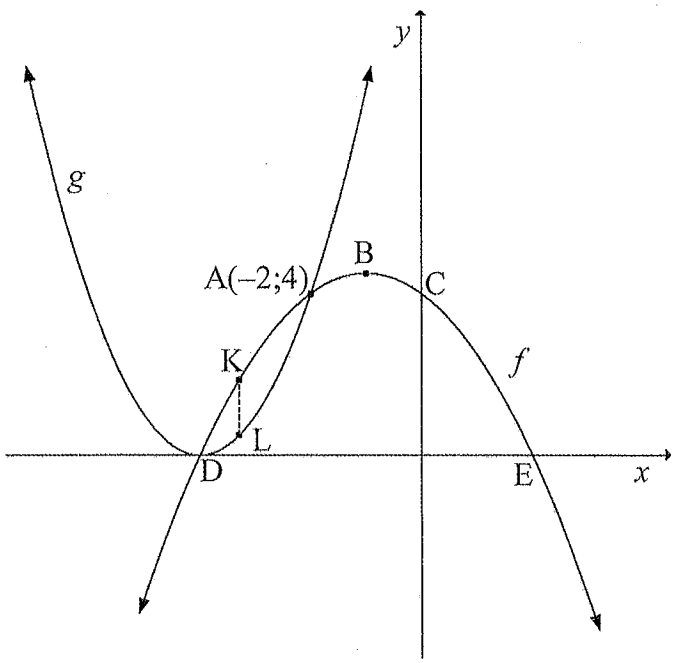
$f(x) = -\frac{1}{2}x^2 - x + 4$.

B is the turning point of f.

$A(-2; 4)$ is a point of intersection between f and g, and C is the y-intercept of f.

D and E are the x-intercepts of f. D is also the x-intercept of g.

K is a point on f and L a point on g, such that KL is parallel to the y-axis, and three units to the left of the y-axis.



6.1 Calculate the coordinates of

6.1.1 B (3)

6.1.2 C (1)

6.2 Calculate the coordinates of D and E. (3)

6.3 Determine the equation of g. (3)

6.4 The graph of g is reflected about the y-axis to obtain the graph of h. Determine the equation of h. (2)

6.5 Determine the value(s) of k such that $-\frac{1}{2}x^2 - x + 4 = k$ will have no real roots. (2)

6.6 Calculate the length of KL. (3)

[17]

TOTAL 100

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MARKING GUIDELINE

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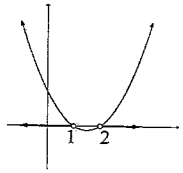
GRADE 11

MARKS: 100

N.B. This marking guideline consists of 8 pages.

QUESTION 1

1.1.1	$(x+3)(x-5)=9$ $x^2-2x-15=9$ $x^2-2x-24=0$ $(x+4)(x-6)=0$ $x=-4$ or $x=6$	1A for multiplying out 1CA for factors 1CA for answers (3)
1.1.2	$x-\sqrt{2x-1}=2$ $\sqrt{2x-1}=x-2$ $2x-1=(x-2)^2$ $2x-1=x^2-4x+4$ $x^2-6x+5=0$ $(x-5)(x-1)=0$ $x=5$ or $x=1$ N/A	1A for isolating surd 1CA for squaring both sides 1CA for factors 1CA for $x=5$ (4)
1.1.3	$1<(2x-3)^2$ $1<4x^2-12x+9$ $-4x^2+12x-8<0$ $4x^2-12x+8>0$ $x^2-3x+2>0$ $(x-2)(x-1)>0$ CVs: 1; 2  $x<1$ or $x>2$ **OR** $(-\infty;1)\cup(2;\infty)$	1A for $-4x^2+12x+8<0$ 1CA for $4x^2-12x+8>0$ 1CA for factorisation 2CA for answer (5)
1.2.1	$3x^2 = 3x+5$ $3x^2-3x-5=0$ $x = \frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $= \frac{-(-3)\pm\sqrt{(-3)^2-4(3)(-5)}}{2(3)}$ $= 1{,}88$ or $-0{,}88$	1A for formula 1A for substitution 2CA for answers (4)

1.2.2	$y+1=1,88$ OR $y+1=-0,88$ $y=0,88$ or $y=-1,88$	2CA for answers (2)
1.3	$x=\frac{3\pm\sqrt{69}}{6}$ The roots are real, irrational and unequal.	1CA for irrational 1CA for unequal (2)
1.4	$y=-2x+1$ equation 1 $2x^2-xy+y^2=4$ equation 2 Substitute equation 1 into equation 2: $2x^2-x(-2x+1)+(-2x+1)^2=4$ $2x^2+2x^2-x+4x^2-4x+1=4$ $8x^2-5x-3=0$ $(8x+3)(x-1)=0$ $x=-\frac{3}{8}$ or $x=1$ $y=\frac{7}{4}$ or $y=-1$	1A for making y the subject of the formula 1CA for substitution 1CA for standard form 1CA for factorization 1CA for both x-values 1CA for both y-values (6) **[26]**

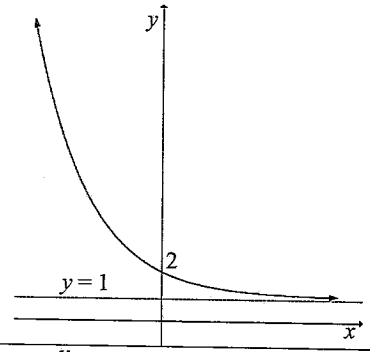
QUESTION 2

2.1.1	$\frac{\sqrt{75}-\sqrt{12}}{x}=\sqrt{48}$ $\frac{5\sqrt{3}-2\sqrt{3}}{x}=4\sqrt{3}$ $\frac{3\sqrt{3}}{x}=4\sqrt{3}$ $x=\frac{3\sqrt{3}}{4\sqrt{3}}$ $=\frac{3}{4}$	1A for $5\sqrt{3}-2\sqrt{3}$ 1A for $4\sqrt{3}$ 1CA for simplification 1CA for answer (4)
2.1.2	$5x^{\frac{3}{2}}-256=x^{\frac{3}{2}}$ $4x^{\frac{3}{2}}=256$ $x^{\frac{3}{2}}=64$ $x=64^{\frac{2}{3}}$ $=\left(2^6\right)^{\frac{2}{3}}$ $=2^4$ $=16$	1A for $x^{\frac{3}{2}}$ 1A for $4x^{\frac{3}{2}}$ 1A for $(64)^{\frac{2}{3}}$ 1 CA for answer (4)
2.2.1	$\left(\frac{1}{\sqrt{2}}+\sqrt{2}\right)^2$ $=\frac{1}{2}+2+2$ $=4\frac{1}{2}$	1 A for $\frac{1}{2}$ 1A for answer (2)
2.2.2	$\sqrt[m]{\frac{6^m+5(3^m)}{10^m+5^{m+1}}}$ $=\sqrt[m]{\frac{2^m.3^m+5.3^m}{5^m.2^m+5.5^m}}$ $=\sqrt[m]{\frac{3^m(2^m+5)}{5^m(2^m+5)}}$ $=\sqrt[m]{\frac{3^m}{5^m}}$ $=\sqrt[m]{\left(\frac{3}{5}\right)^m}$ $=\frac{3}{5}$	1 A for expanding 1 CA for factorisation 1 CA for simplification 1 CA for answer (4) **[14]**

QUESTION 3

3.1.1	40	1A for answer (1)
3.1.2	4 10 18 28 6 8 10 2 2 $2a = 2$ $3a+b=1$ $a+b+c=4$ $a = 1$ $b = 3$ $c = 0$ $T_n = n^2+3n$	1A for $a = 1$ 1CA for $b = 3$ 1CA for $c = 0$ 1CA for T_n (4)
3.1.3	$n^2+3n=460$ $n^2+3n-460=0$ $(n-20)(n+23)=0$ $n=20$ $T_{21}=21^2+3(21)$ $=504$	1CA for equating T_n to 460 1CA for factorisation 1CA for value of n 1CA for value of the next term (4)
3.1.4	First differences: 6; 8; 10; … $T_n = 2n+4$	1A for $2n$ 1A for $+4$ (2)
3.1.5	$2n+4=64$ $n=30$ Between T_{30} and T_{31}	1A for $n=30$ 1A for T_{30} 1A for T_{31} (3)
3.2	13 x 29 $x+24$ $x-13$ $29-x$ $x-5$ first differences $-2x+42$ $2x-34$ second differences $-2x+42 = 2x-34$ $4x = 76$ $x = 19$	1A for $x-13$ 1 A for $29-x$ and $x-5$ 1CA for 2nd differences 1CA for equating second differences 1CA for answer (5) **[19]**

QUESTION 4

4.1	$h(0)=2^0+1$ $=2$	1A for substitution 1A for answer (2)
4.2	$y=1$	1A for answer (1)
4.3		1A for shape 1CA for y-intercept 1CA for asymptote (3)
4.4	Average gradient $=\frac{f(0)-f(-2)}{0-(-2)}$ $=\frac{2-5}{2}$ $=-\frac{3}{2}$	1A for formula 1A for $f(-2)=5$ 1CA for answer (3)
4.5	$x<-2$	2A for answer (2) **[11]**

QUESTION 5

5.1	$p=3$ $q=-2$ $y=\frac{a}{x+3}-2$ Substitute $(-5;0)$: OR Substitute $(1;-3)$: $0=\frac{a}{-5+3}-2$ $-3=\frac{a}{1+3}-2$ $2=\frac{a}{-2}$ $-1=\frac{a}{4}$ $a=-4$ $a=-4$	1A for $p=3$ 1A for $q=-2$ 1CA for substitution 1CA for answer (4)
5.2	$x\in\Re$, but $x\neq -3$ OR $(-\infty;-3)$ or $(-3;\infty)$	2A for answer (2)
5.3	Substitute $(-3;-2)$ in $y=x+k$: $-2=-3+k$ $k=1$	1A for substitution 1A for answer (2)
5.4	$-5\leq x<-3$ or $x\geq 1$ OR $[-5;-3)\cup[1;\infty)$	2A for $-5\leq x<-3$ 1A for $x\geq 1$ (3)
5.5	Gradient $=\frac{-3-0}{1+5}$ $=-\frac{1}{2}$ $y=-\frac{1}{2}x-\frac{5}{2}$	1A for gradient 1CA for answer (2) **[13]**

QUESTION 6

6.1.1	$x=\frac{-b}{2a}$ $=\frac{-(-1)}{2\left(-\frac{1}{2}\right)}$ $=-1$ $f(-1)=-\frac{1}{2}(-1)^2-(-1)+4=4\frac{1}{2}$ $B\left(-1;4\frac{1}{2}\right)$	1A for substitution 1A for answer (x-coordinate) 1CA for y-coordinate (3)
6.1.2	$C(0;4)$	1A for answer (1)
6.2	$-\frac{1}{2}x^2-x+4=0$ $x^2+2x-8=0$ $(x+4)(x-2)=0$ $x=-4$ or $x=2$ $D(-4;0)$ $E(2;0)$	1A for $-\frac{1}{2}x^2-x+4=0$ 1A for factors 2CA for answers (3)
6.3	$y=a(x+4)^2$ $4=a(-2+4)^2$ $4=a(2)^2$ $a=1$ $y=(x+4)^2$	1A for $y=a(x+4)^2$ 1A for substituting $(-2;4)$ 1CA for answer (3)
6.4	$y=(x-4)^2$ $=x^2-8x+16$	$(x-4)^2$ OR $x^2-8x+16$ 2A for answer (2)
6.5	$k>4\frac{1}{2}$	2A for answer (2)
6.6	$f(x)-g(x)$ $=-\frac{1}{2}x^2-x+4-(x+4)^2$ $=-\frac{1}{2}x^2-x+4-x^2-8x-16$ $=-\frac{3}{2}x^2-9x-12$ $f(-3)-g(-3)$ $=-\frac{3}{2}(-3)^2-9(-3)-12$ $=\frac{3}{2}$	1A: $-\frac{1}{2}x^2-x+4-(x+4)^2$ 1A: simplification 1CA: answer (3) **[17]**

TOTAL: 100

