Education

KwaZulu-Natal Department of Education

REPUBLIC OF SOUTH AFRICA

GR 11 MATHS

MATHEMATICS

COMMON TEST

MARCH 2017

NATIONAL SENIOR CERTIFICATE

GRADE 11

MARKS: 75

TIME: 1½ hours

N.B. This question paper consists of 6 pages.

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INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

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

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QUESTION 1

1.1 Solve for x:

1.1.1 $4x(x-5)=0$ (2)

1.1.2 $3x^2+7x-5=0$ (correct to 2 decimal places) (4)

1.1.3 $x-1=\sqrt{7-3x}$ (4)

1.1.4 $2x^2-5x+3\leq 1$ (4)

1.1.5 $5^{2x}-4.5^{x+1}=125$ (4)

1.2 Solve for x and y simultaneously:

$2y+8-8x=0$
$2x^2+4x=y^2+6$ (6)

[24]

QUESTION 2

2.1 Simplify without the use of a calculator:

2.1.1 $(2^6)^6 \div \sqrt{2^{66}}$ (3)

2.1.2 $\dfrac{21^p-21^{p-1}}{7^{p-2}.3^{p-2}}$ (4)

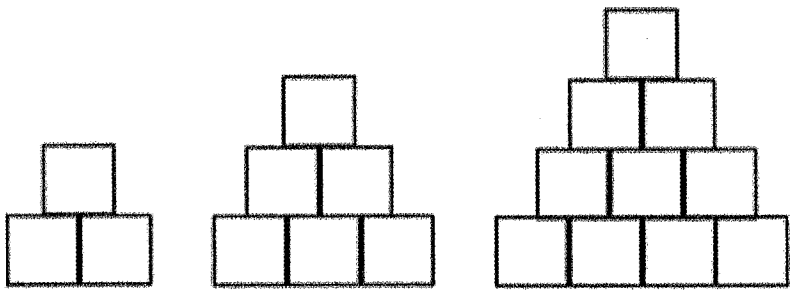
2.2 For which values of m will the roots of $2x^2+x+m=0$ be real? (3)

[10]

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QUESTION 3

3.1 Peter builds triangular patterns with blocks in his yard, as shown in the sketch.



Pattern 1 Pattern 2 Pattern 3

3.1.1 How many blocks will he need to build the 4^{th} triangular pattern? (2)

3.1.2 Derive a formula to calculate the number of blocks in the n^{th} triangular pattern. (4)

3.1.3 Determine the number of blocks in the 50^{th} triangular pattern. (2)

3.1.4 Which triangular pattern will have 496 blocks? (4)

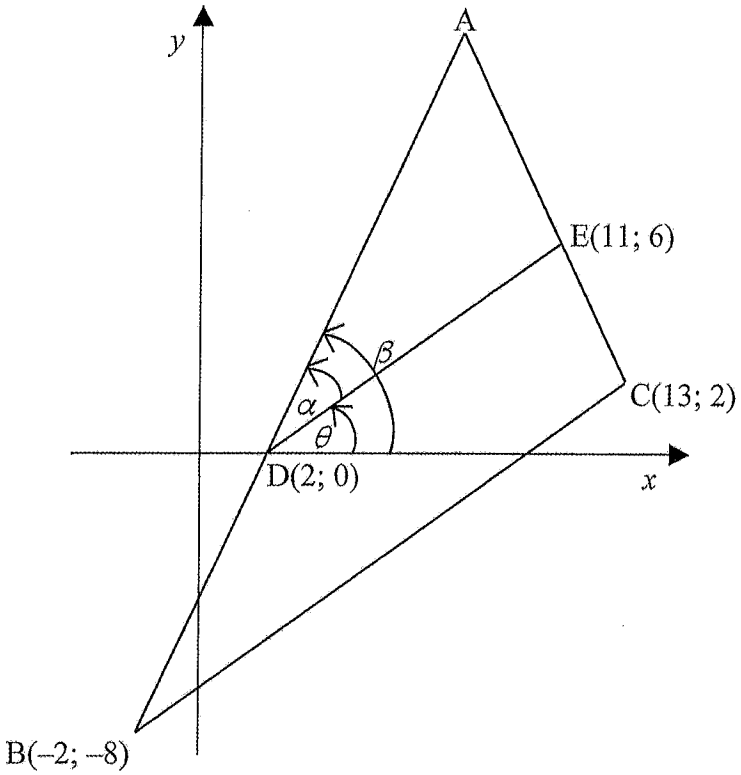
3.2 The general term of a certain quadratic number pattern is $T_n = 2n^2 - 5$.
Calculate the 50^{th} term of the sequence of first differences of this quadratic number pattern. (4)

[16]

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QUESTION 4

4.1 A, B(–2; –8) and C(13; 2) are the vertices of a triangle ABC in the Cartesian plane. D(2; 0) and E(11; 6) are points on AB and AC respectively. Angles α, β and θ have been indicated on the diagram.

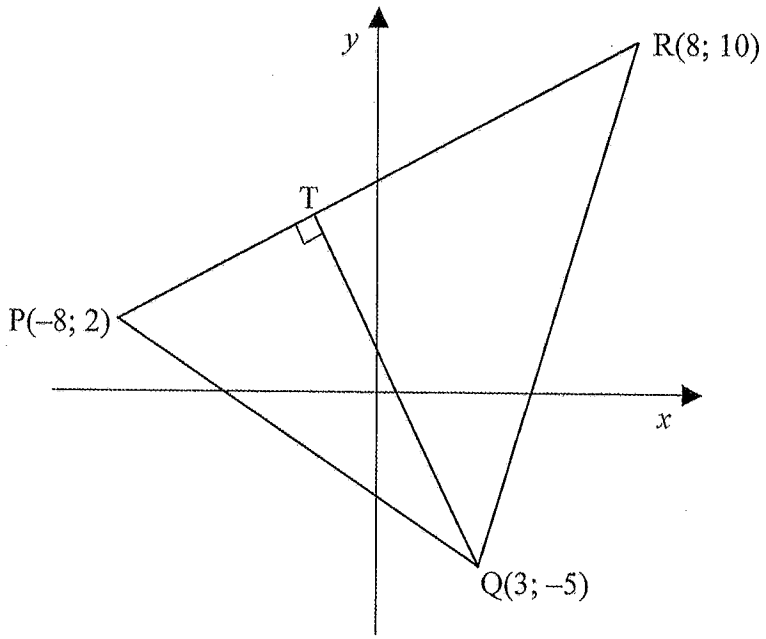


4.1.1 Prove that DE is parallel to BC. Show all your calculations. (4)

4.1.2 Calculate the size of angle θ. (2)

4.1.3 Calculate the size of $\hat{B}$. (5)

4.2 P(–8; 2), Q(3; –5), and R(8; 10) are the vertices of a triangle PQR in the Cartesian plane. QT is perpendicular to PR, with T on PR.



4.2.1 Determine the equation of PR in the form $y = mx + c$. (4)

4.2.2 Calculate the coordinates of T. (5)

4.2.3 If the coordinates of T are (–2; 5), calculate the area of triangle PQR. (5)

[25]

TOTAL: 75

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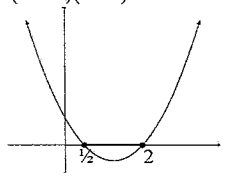
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QUESTION 1

1.1.1	$x=0$ ✓ or $x=5$ ✓	2A for both values of x (2)
1.1.2	$3x^2+7x-5=0$ $x = \frac{-b\pm\sqrt{b^2-4ac}}{2a}$ ✓ $= \frac{-7\pm\sqrt{7^2-4(3)(-5)}}{(2)(3)}$ ✓ $= 0{,}57$ ✓ or $-2{,}91$ ✓	1M for correct formula 1A for correct substitution 2CA for answers (4)
1.1.3	$x-1=\sqrt{7-3x}$ $x^2-2x+1=7-3x$ ✓ $x^2+x-6=0$ ✓ $x=-3$ or $x=2$ ✓ N/A ✓	1A for squaring both sides 1CA for standard form 1CA for both values of x 1CA for correct solution (4)
1.1.4	$2x^2-5x+2\le 0$ ✓ $(2x-1)(x-2)\le 0$ ✓  $\frac{1}{2}\le x\le 2$ ✓ ✓	1A for standard form 1A for factors 2CA for inequality (4)
1.1.5	$5^{2x}-4.5^{x+1}=125$ $5^{2x}-20.5^x-125=0$ ✓ $(5^x-25)(5^x+5)=0$ ✓ $5^x=25$ or $5^x=-5$ ✓ $x=2$ ✓ no solution	1A for 20 1CA for factors 1CA for values of 5^x 1CA for answer $(x=2$ only) (4)

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1.2	$\therefore y = 4x - 4$ ✓ eqn. 1 $2x^2 + 4x = y^2 + 6$ eqn. 2 Substitute eqn.1 in eqn. 2 $2x^2 + 4x = (4x-4)^2 + 6$ ✓ $2x^2 + 4x = 16x^2 - 32x + 16 + 6$ ✓ $14x^2 - 36x + 22 = 0$ $7x^2 - 18x + 11 = 0$ ✓ $(7x-11)(x-1) = 0$ $x = \frac{11}{7}$ or $x = 1$ ✓ $y = 2\frac{2}{7}$ or $y = 0$ ✓	1A for making y the subject of the formula 1CA for substituting for y 1CA for simplifying 1CA for standard form 1CA for both values of x 1CA for both values of y (6) **[24]**

QUESTION 2

2.1.1	$(2^6)^6 \div \sqrt{2^{66}}$ $= 2^{36} \div (2^{66})^{\frac{1}{2}}$ ✓ $= 2^{36} \div 2^{33}$ ✓ $= 2^3$ $= 8$ ✓	1A for writing 2^{36} 1A for writing 2^{33} 1CA for answer (3)
2.1.2	$\frac{21^p - 21^{p-1}}{7^{p-2}.3^{p-2}}$ $= \frac{7^p 3^p - 7^{p-1}3^{p-1}}{7^p 7^{-2}.3^p 3^{-2}}$ $= \frac{7^p.3^p(1-7^{-1}.3^{-1})}{7^p.3^p.7^{-2}3^{-2}}$ ✓ $= \frac{20}{21} \times \frac{49 \times 9}{1}$ ✓ $= 420$ ✓ OR $\frac{21^p - 21^{p-1}}{7^{p-2}.3^{p-2}}$ $= \frac{21^p(1-21^{-1})}{21^p.7^{-2}.3^{-2}}$ ✓ ✓ $= \frac{20}{21} \times \frac{49 \times 9}{1}$ ✓ $= 420$ ✓	1A for taking out common factor in numerator 1A for splitting exponents in denominator 1 CA simplification 1 CA for answer (4) OR 1A for taking out common factor in numerator 1A for splitting exponents in denominator 1 CA simplification 1 CA for answer (4)
2.2	$\Delta = b^2 - 4ac \geq 0$ ✓ $1^2 - 4(2)(m) \geq 0$ ✓ $-8m \geq -1$ $m \leq \frac{1}{8}$ ✓	1A for statement 1A for substitution 1CA for answer (3) **[10]**

QUESTION 3

3.1.1	15 ✓ ✓	2A for answer (2)
3.1.2	$2a = 1$ $a = \frac{1}{2}$ ✓ $3a + b = 3$ $\frac{3}{2}a + b = 3$ $b = \frac{3}{2}$ ✓ $a + b + c = 3$ c =1 ✓ $\therefore \quad T_n = \frac{1}{2}n^2 + \frac{3}{2}n + 1$ ✓	1A for the value of a 1A for the value of b 1 CA for the value of c 1 CA for n th term (4)
3.1.3	$T_{50} = \frac{1}{2}(50)^2 + \frac{3}{2}(50) + 1$ ✓ $= 1326$ ✓	1CA for substituting n = 50 1CA for answer. (2)
3.1.4	$\frac{1}{2}n^2 + \frac{3}{2}n + 1 = 496$ ✓ $n^2 + 3n - 990 = 0$ ✓ $n = \frac{-3 \pm \sqrt{(3)^2 - 4(1)(990)}}{2(1)}$ ✓ $n = 30$ *or* $n = -33$ $\therefore 30^{th}$ triangular pattern.✓	1CA for equating 1CA for standard form 1CA for correct substitution (or factors) 1CA for rejecting – 33 (4)
3.2	Quadratic number pattern: $-3; 3; 13; 27; \ldots$ ✓ Sequence of first differences: 6; 10; 14; … ✓ General term of sequence of first differences: $T_n = 4n + 2$ ✓ $T_{50} = 4(50) + 2$ $= 202$ ✓	1A for quadratic number pattern 1CA for sequence of first differences 1CA for T_n 1CA for answer (4) **[16]**

QUESTION 4

4.1.1	$m_{DE} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{6-0}{11-2}$ ✓ $= \frac{2}{3}$ ✓ $m_{BC} = \frac{2-(-8)}{13-(-2)}$ $= \frac{2}{3}$ ✓ $\therefore m_{DE} = m_{BC}$; and therefore DE is parallel to BC ✓	1A for substitution into gradient formula 1CA for gradient of DE 1A for gradient of BC 1A for conclusion (4)
4.1.2	$m = \tan\theta$ $\frac{2}{3} = \tan\theta$ ✓ $\theta = \tan^{-1}\left(\frac{2}{3}\right)$ $= 33.69^\circ$ ✓	1CA for substitution 1CA for correct answer (2)
4.1.3	$m_{ADB} = \frac{0-(-8)}{2-(-2)}$ $= 2$ ✓ $\beta = \tan^{-1}(2)$ $= 63{,}43^\circ$ ✓ $\alpha = \beta - \theta$ $= 63{,}43^\circ - 33{,}69^\circ$ ✓ $= 29{,}74^\circ$ ✓ $\hat{B} = \alpha$ ✓ $= 29{,}74^\circ$ because of corresponding angles and parallel lines	1A for m_{ADB} 1CA for size of angle β 1CA for subtracting 1CA for size of angle α 1CA for size of $\hat{B}$ (5)
4.2.1	$m_{PR} = \frac{10-2}{8-(-8)}$ $= \frac{1}{2}$ ✓ Substitute m_{PR} and (8; 10): $y = mx + c$ $10 = \left(\frac{1}{2}\right)8 + c$ ✓ ✓ $c = 6$ $y = \frac{1}{2}x + 6$ ✓	1A for gradient of PR 1A for substituting coordinates of point 1CA for substituting gradient 1CA for equation (4)

4.2.2	$m_{TQ}.m_{PR} = -1$ because TQ ⊥ PR $\therefore m_{TQ} = -2$ ✓ Substitute m_{TQ} and (3; –5) to determine equation of TQ: $y = mx + c$ $-5 = (-2)(3) + c$ ✓ $c = 1$ $y = -2x + 1$ ✓ At T: $\frac{1}{2}x + 6 = -2x + 1$ ✓ $\frac{5x}{2} = -5$ ✓ $x = -2$ $y = -2(-2) + 1$ $= 5$	1A for gradient of TQ 1CA for substitution 1CA for equation 1CA for solving simultaneously 1CA for simplifying (5)
4.2.3	PR $= \sqrt{[8-(-8)]^2 + [10-2]^2}$ ✓ $= \sqrt{320}$ $= 8\sqrt{5}$ $= 17{,}89$ ✓ $TQ = \sqrt{[-5-5]^2 + [3-(-2)]^2}$ $= \sqrt{125}$ $= 5\sqrt{5}$ $= 11{,}18$ ✓ Area $= \frac{1}{2} \times$ base $\times$ height $= \frac{1}{2} \times 17{,}89 \times 11{,}18$ ✓ $= 100$ units^2 ✓	1A for substitution 1CA for answer $\sqrt{320}$ or $8\sqrt{5}$ or 17,89 1CA for answer $\sqrt{125}$ or $5\sqrt{5}$ or 11,18 1CA for substitution 1CA for answer (5) **[25]**

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