



Basic Education
KwaZulu-Natal Department of Education
REPUBLIC OF SOUTH AFRICA

MATHEMATICS

COMMON TEST

SEPTEMBER 2015

**NATIONAL
SENIOR CERTIFICATE**

GRADE 10

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 6 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, et cetera, which you have used in determining the 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 to TWO decimal places, unless stated otherwise.
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.

QUESTION 1

1.1 In which quadrant will θ lie if $0^\circ \leq \theta \leq 360^\circ$ and $\sin \theta > 0$ and $\tan \theta < 0$? (2)

1.2 Determine, **without using a calculator**, the value of $\frac{\sin 45^\circ \cdot \operatorname{cosec} 90^\circ}{\sqrt{3} \cos 0^\circ \cdot \tan 60^\circ}$. (5)

1.3 If $13 \cos \theta = -5$ and $180^\circ \leq \theta \leq 360^\circ$, determine, using a suitable diagram and **without the use of a calculator**, the value of:

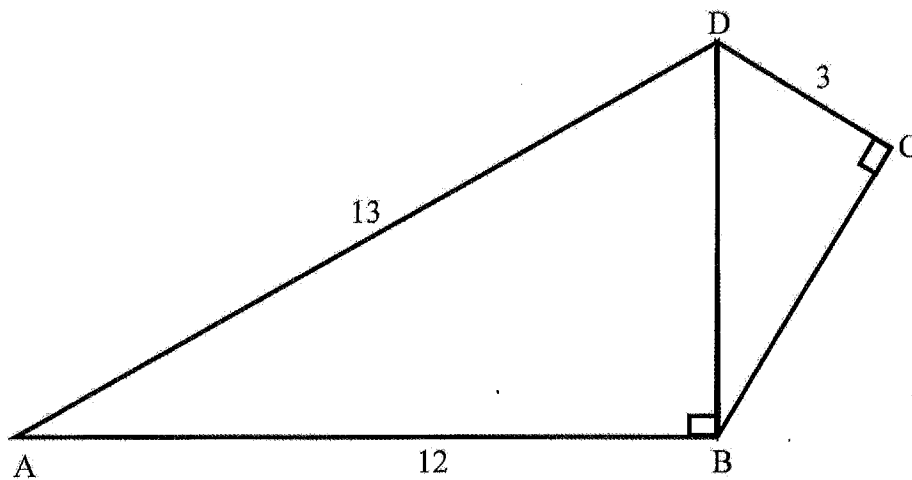
1.3.1 $\cot \theta$ (4)

1.3.2 $\sin^2 \theta - \cos^2 \theta$ (3)

[14]

QUESTION 2

In the diagram below, $AD = 13$ units, $AB = 12$ units and $DC = 3$ units. $\hat{D}BA$ and $\hat{D}CB$ are two right angles in quadrilateral $ABCD$.



2.1 Calculate the length of DB and BC . (4)

2.2 Hence determine the value of the following, **without the use of a calculator**:

2.2.1 $\tan A$ (1)

2.2.2 $\sec \hat{A}DB + \sin \hat{D}BC$ (3)

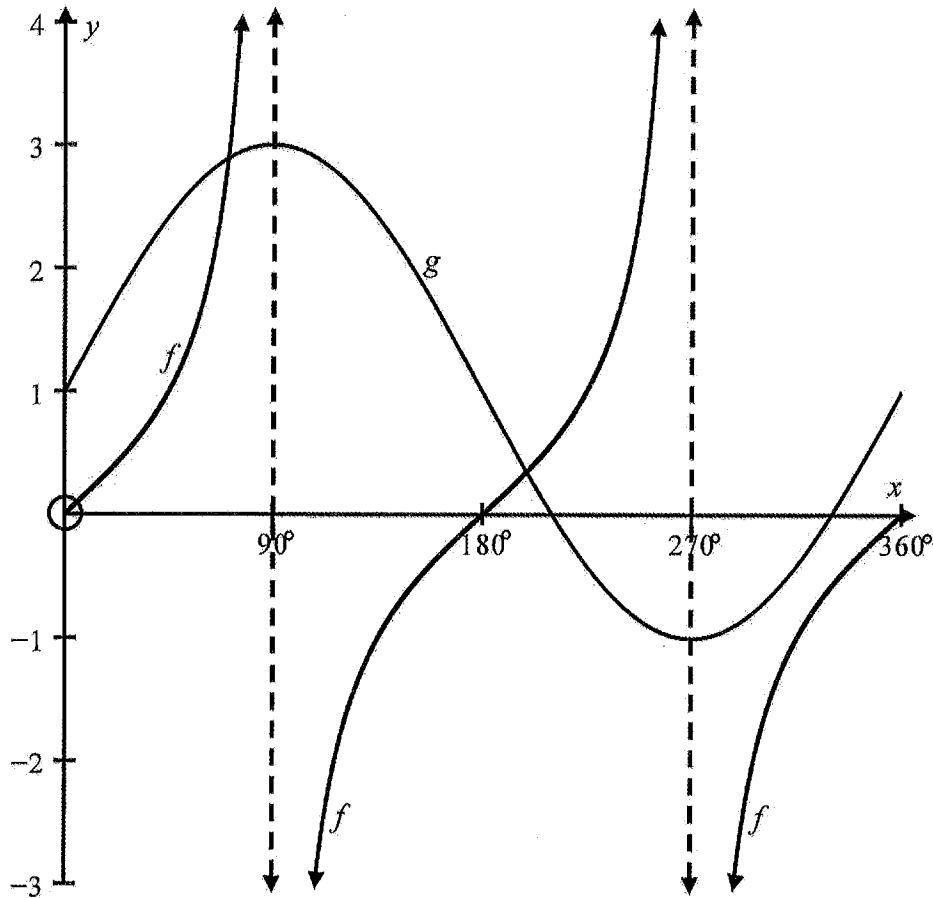
2.3 Use your calculator to determine the size of angle A , correct to ONE decimal place. (2)

[10]

QUESTION 3

The following graphs have been drawn below for $x \in [0^\circ; 360^\circ]$:

$$f(x) = \tan x \text{ and } g(x) = a \sin x + q$$



Use the graphs to answer the following questions for $x \in [0^\circ; 360^\circ]$:

- 3.1 Determine the value of a and q . (2)
 - 3.2 Write down the period of f . (1)
 - 3.3 Write down the range of g . (2)
 - 3.4 Write down the values of x for which f is undefined. (2)
 - 3.5 Determine the values of x for which $g(x) = 1$. (3)
- [10]**

QUESTION 4

Ayanda plans to travel to New Zealand. Her flight has been paid for by her parents. However, she will need spending money of about NZ\$ 150.

- 4.1 If the exchange rate is currently 8,8595 Rand to the NZ\$, how much will she need in South African Rand in order to have enough spending money? (2)
- 4.2 Ayanda has just received a gift of R500 from her grandmother and her grandmother promises to give her another R500 in a year's time. Ayanda decides to invest this money in an account which pays 8,5% p.a. compounded annually. How much will she have in her account after two years? (6)
- 4.3 How much additional money will she have to add to her investment after two years if she withdraws all the money for her trip? (2)
- [10]**

QUESTION 5

- 5.1 A bag contains 7 red marbles and 5 green marbles. One marble is drawn out of the bag at random.

Calculate the probability that it is:

- 5.1.1 a red marble (1)
- 5.1.2 an orange marble (1)
- 5.1.3 a red or a green marble (1)
- 5.1.4 not a red marble (1)

- 5.2 There are 120 grade 10 learners at a school. 55 learners take Mathematics and 80 learners take Life Sciences. There are 25 learners who do not do Mathematics or Life Sciences and the number of learners who take both Mathematics and Life Sciences = x .

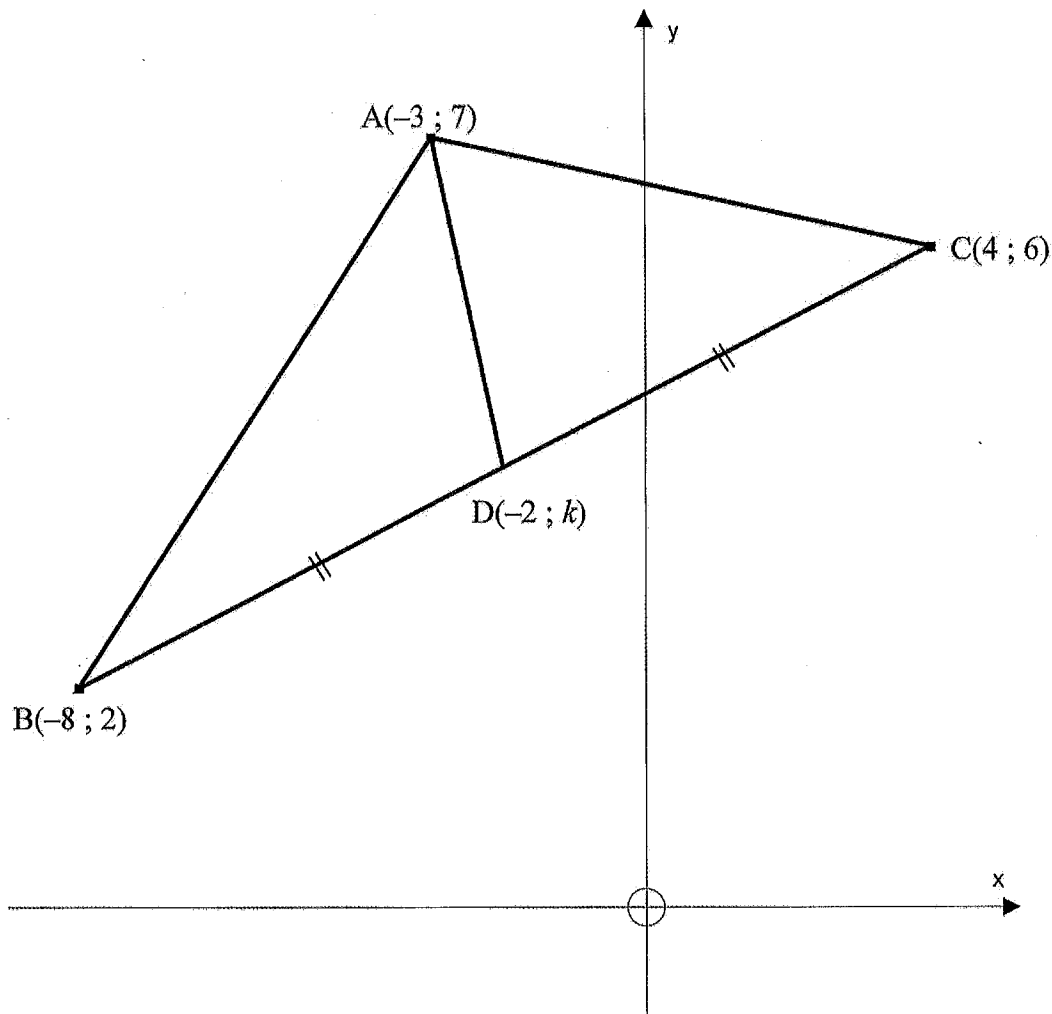
- 5.2.1 Represent this information in a Venn diagram. Let $M = \{\text{learners who take Mathematics}\}$, $LS = \{\text{learners who take Life Sciences}\}$. (3)
- 5.2.2 Calculate the value of x (2)

Use the Venn Diagram to calculate the probability that a randomly chosen learner:

- 5.2.3 takes Mathematics only (2)
- 5.2.4 takes Mathematics and Life Sciences (2)
- 5.2.5 takes Mathematics or Life Sciences (2)
- [15]**

QUESTION 6

In the diagram below $A(-3 ; 7)$, $B(-8 ; 2)$ and $C(4 ; 6)$ are the vertices of triangle ABC . AD is drawn such that $D(-2 ; k)$ is the midpoint of BC .



- 6.1 Calculate the gradient of BC . (2)
- 6.2 Calculate the length of BC . (2)
- 6.3 Determine the value of k . (2)
- 6.4 Determine the equation of a line that is parallel to BC and passes through $A(-3 ; 7)$. (3)
- 6.5 If the value of k is 4, prove that $AD \perp BC$. (3)
- 6.6 Hence, calculate the area of $\triangle ABC$. (4)
- [16]**

TOTAL: 75



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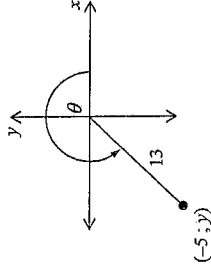
GRADE 10

MARKS: 75

SYMBOL	DESCRIPTION
✓M	Mark for correct method
✓A	Mark for total accuracy
✓CA	Mark for consistent accuracy

This memorandum consists of 6 pages.

QUESTION 1

1.1	2 nd quadrant	✓✓ A	(2)	
1.2	$\frac{\sin 45^\circ \cdot \operatorname{cosec} 90^\circ}{\sqrt{3} \cos 0^\circ \cdot \tan 60^\circ}$ $= \frac{\frac{\sqrt{2}}{2} \left(\frac{1}{1}\right)}{\sqrt{3} \left(\frac{1}{1}\right) \left(\frac{\sqrt{3}}{1}\right)}$ $= \frac{\frac{\sqrt{2}}{2}}{3}$ $= \frac{\sqrt{2} \times 1}{2 \times 3}$ $= \frac{\sqrt{2}}{6}$	✓✓✓✓ 4A special angle values		
1.3.1	$13 \cos \theta = -5$ $\cos \theta = \frac{-5}{13}$	 <p> $(-5)^2 + y^2 = 13^2$ $y^2 = 169 - 25$ $y^2 = 144$ $y = -12$ $\cot \theta = \frac{-5}{-12}$ $= \frac{5}{12}$ </p>	✓CA answer Answer only: no marks ✓A $\cos \theta = \frac{-5}{13}$ ✓M diagram in quadrant 3	(5)
		✓A y – value	(4)	
		✓A answer	(4)	

1.3.2	$\sin^2 \theta - \cos^2 \theta$ $= \left(\frac{-12}{13}\right)^2 - \left(\frac{-5}{13}\right)^2$ $= \frac{144}{169} - \frac{25}{169}$ $= \frac{119}{169}$	✓ CA $\sin \theta = \frac{-12}{13}$ ✓ CA $\cos \theta = \frac{-5}{13}$ ✓ CA answer	(3) 14
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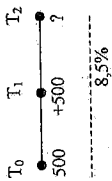
QUESTION 2

2.1	$DB^2 = 13^2 - 12^2$ $= 25$ $DB = 5$ $BC^2 = 5^2 - 3^2$ $= 16$ $BC = 4$ $\tan A = \frac{5}{12}$	Theorem of Pythagoras Theorem of Pythagoras	✓ M using Pythagoras ✓ A answer ✓ M using Pythagoras ✓ CA answer ✓ A answer	(4) (1)
2.2.1	$\sec \hat{A}DB + \sin \hat{D}BC$ $= \frac{13}{5} + \frac{3}{5}$ $= \frac{16}{5}$		✓ CA $\sec \hat{A}DB = \frac{13}{5}$ ✓ CA $\sin \hat{D}BC = \frac{3}{5}$ ✓ CA answer	(3)
2.3	$\tan A = \frac{5}{12}$ $A = \tan^{-1}\left(\frac{5}{12}\right)$ $= 22,6^\circ$	NOTE: Accept any correct trigonometric ratio	✓ CA $A = \tan^{-1}\left(\frac{5}{12}\right)$ ✓ CA answer	(2) 10

QUESTION 3

3.1	$a \sin 0^\circ + q = 1$ $0 + q = 1$ $q = 1$ $a \sin 90^\circ + 1 = 3$ $a + 1 = 3$ $a = 2$	✓ A $q = 1$ ✓ A $a = 2$	(2)
3.2	Period of $f = 180^\circ$	✓ A answer	(1)
3.3	Range of g is $-1 \leq y \leq 3$ OR $y \in [-1; 3]$	✓ A / A answer	(2)
3.4	$x = 90^\circ$ or $x = 270^\circ$	✓ A / A answer	(2)
3.5	$x = 0^\circ$ or $x = 180^\circ$ or $x = 360^\circ$	✓ A / A answer	(3)
			10

QUESTION 4

4.1	Ayanda's spending money = $150 \times 8,8595$ = R1328,93	✓ A $150 \times 8,8595$ ✓ A answer	(2)
4.2	 $A = 500(1 + 0,085)^2 + 500(1 + 0,085)$ $= R1131,11$	✓ A $500(1 + 0,085)$ ✓ A $n = 2$ ✓ A $+ 500(1 + 0,085)$ ✓ A answer	(6)
4.3	Ayanda still needs R1328,93 - R1131,11 = R197,82	✓ CA calculating the difference ✓ CA answer	(2) 10

QUESTION 5

5.1.1	$P(\text{red marble}) = \frac{7}{12} = 0,58$	✓A answer	(1)
5.1.2	$P(\text{orange marble}) = 0$	✓A answer	(1)
5.1.3	$P(\text{red marble or green marble}) = \frac{7}{12} + \frac{5}{12} = 1$	✓A answer	(1)
5.1.4	$P(\text{not red marble}) = \frac{5}{12} = 0,42$	✓A answer	(1)
5.2.1		✓A 25 ✓A 55 - x ✓A 80 - x	(3)
5.2.2	$55 - x + x + 80 - x + 25 = 120$ $160 - x = 120$ $x = 160 - 120$ $x = 40$	✓A $55 - x + x + 80 - x + 25 = 120$ ✓A answer	(2)
5.2.3	$P(\text{Mathematics only}) = \frac{15}{120} = 0,13$	✓A ✓A answer	(2)
5.2.4	$P(\text{Mathematics and Life Sciences}) = \frac{40}{120} = 0,33$	✓A ✓A answer	(2)
5.2.5	$P(\text{Mathematics or Life Sciences}) = \frac{15 + 40 + 40}{120} = \frac{95}{120} = 0,79$ Or $P(\text{Mathematics or Life Sciences}) = \frac{120 - 25}{120} = \frac{95}{120} = 0,79$	✓A ✓A answer	(2)
			15

QUESTION 6

6.1	$m_{BC} = \frac{6-2}{4+8}$ $= \frac{4}{12}$ $= \frac{1}{3}$	✓M substitution into gradient formula ✓A	(2)
6.2	$BC = \sqrt{(4+8)^2 + (6-2)^2}$ $= \sqrt{160}$ $= 12,65$	✓M substitution into distance formula ✓A	(2)
6.3	$k = \frac{6+2}{2}$ $= 4$	✓M substitution into midpoint formula ✓A: answer	(2)
6.4	$m_{line} = m_{BC} = \frac{1}{3}$ Equation of line is $y - 7 = \frac{1}{3}(x + 3)$ $y - 7 = \frac{1}{3}x + 1$ $y = \frac{1}{3}x + 8$	✓A equal gradients ✓M substitution of (-3; 7) into equation ✓A answer	(3)
6.5	$m_{AD} = \frac{7-4}{-3+2}$ $= \frac{3}{-1}$ $= -3$ $m_{BC} \times m_{AD} = \frac{1}{3} \times -3$ $= -1$ $\therefore BC \perp AD$	✓M substitution into gradient formula ✓A ✓A conclusion	(3)
6.6	$AD = \sqrt{(-3+2)^2 + (7-4)^2}$ $= \sqrt{10}$ $= 3,16$ Area of triangle = $\frac{1}{2} \sqrt{160} \times \sqrt{10}$ $= 20$ square units	✓M substitution into distance formula ✓A ✓M substitution into area formula ✓A answer	(4)
			16

