



# Basic Education

KwaZulu-Natal Department of Education  
REPUBLIC OF SOUTH AFRICA

**MATHEMATICS**

**COMMON TEST**

**MARCH 2016**

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 10**

**MARKS: 50**

**TIME: 1 hour**

**This question paper consists of 4 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. Number the answers correctly according to the numbering system used in this question paper.
8. Write neatly and legibly.

**QUESTION 1**

- 1.1 Determine the product of the following and simplify fully:

$$(x-4)(x^2+4x+16) \quad (2)$$

- 1.2 Factorise the following completely:

$$p^2+2pq+q^2-r^2 \quad (3)$$

- 1.3 Simplify the following expression fully:

$$\frac{x}{x^2+3x+2} + \frac{x}{x^2-4} \quad (5)$$

**[10]****QUESTION 2**

- 2.1 The total surface area of a closed right cylinder is given by
- $S = 2\pi r^2 + 2\pi rh$
- . Write down
- $h$
- , the height of the cylinder, in terms of
- $S$
- ,
- $\pi$
- and
- $r$
- . (2)

- 2.2 Solve for
- $x$
- and
- $y$
- if:

$$x+2y=4 \quad \text{and} \quad 4x+5y=1 \quad (4)$$

- 2.3 Solve the following inequality:
- $1-5x > 3x-7$
- .

**Hence**, illustrate your answer on a number line if  $x$  is a real number. (4)

- 2.4 Solve for
- $x$
- :
- $(x-3)(x+2) = -6$
- (4)

- 2.5 The length of a rectangle is 40 cm longer than its breadth. If the area of the rectangle is
- $1200 \text{ cm}^2$
- , calculate the length of the rectangle. (4)

**[18]**

**QUESTION 3**

If  $p + q^{-1} = -3$  and  $p^2 + q^{-2} = 6$ , calculate the value of  $\frac{p}{q}$ . [3]

**QUESTION 4**

4.1 Without using a calculator, simplify the following expressions fully:

4.1.1  $(x - y)^0 + \left(\frac{1}{2}\right)^{-2} - 2^5$  (4)

4.1.2  $\frac{6^{x-2} \cdot 2^{x+2}}{4^x \cdot 3^{x-4}}$  (4)

4.2 Solve for  $x$  in each of the following equations:

4.2.1  $5^x = 1$  (1)

4.2.2  $2^{x+1} - 2^x = 16$  (3)

[12]

**QUESTION 5**

If  $5^x = 25$ , determine the value of  $5^{x-2}$ . [3]

**QUESTION 6**

The area of a square is  $45 \text{ cm}^2$ .

6.1 Is the length of the side of the square a rational number or an irrational number? Explain your answer. (2)

6.2 Without calculating the length of the side of the square, show that its value lies between 6 and 7. (2)

[4]

**TOTAL MARKS: 50**



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MATHEMATICS  
COMMON TEST  
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MEMORANDUM

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**GRADE 10**

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This memorandum consists of 5 pages.

**QUESTION 1**

1.1	$(x-4)(x^2+4x+16)$ $= x^3 - 64$	✓ ✓ answer (2)
1.2	$p^2 + 2pq + q^2 - r^2$ $= (p+q)^2 - r^2$ $= (p+q+r)(p+q-r)$	✓ $(p+q)^2$ ✓ $(p+q+r)$ ✓ $(p+q-r)$ (3)
1.3	$\frac{x}{x^2+3x+2} + \frac{x}{x^2-4}$ $= \frac{x}{(x+1)(x+2)} + \frac{x}{(x+2)(x-2)}$ $= \frac{x(x-2) + x(x+1)}{(x+1)(x+2)(x-2)}$ $= \frac{x^2 - 2x + x^2 + x}{(x+1)(x+2)(x-2)}$ $= \frac{2x^2 - x}{(x+1)(x+2)(x-2)}$ $= \frac{x(2-x)}{(x+1)(x+2)(x-2)}$ $= \frac{-x(x-2)}{(x+1)(x+2)(x-2)}$ $= \frac{-x}{(x+1)(x+2)}$	✓ factorising the denominators ✓ writing both fractions in the same denominator  ✓ simplification  ✓ switching terms around  ✓ answer (5)
		<b>10</b>

QUESTION 2

2.1	$S = 2\pi r^2 + 2\pi rh$ $2\pi rh = S - 2\pi r^2$ $h = \frac{S - 2\pi r^2}{2\pi r}$	$\checkmark 2\pi rh = S - 2\pi r^2$ $\checkmark h = \frac{S - 2\pi r^2}{2\pi r}$ <p>N.B. Answer only: full marks (2)</p>	$\checkmark x + 2y = 4$ $\Rightarrow x = 4 - 2y$ $4x + 5y = 1$ $4(4 - 2y) + 5y = 1$ $16 - 8y + 5y = 1$ $-8y + 5y = 1 - 16$ $-3y = -15$ $y = 5$ $x = 4 - 2(5)$ $= -6$	$\checkmark x = 4 - 2y$ $\checkmark$ substitution $\checkmark y = 5$ $\checkmark x = -6$	(4)
2.2	$1 - 5x > 3x - 7$ $-5x - 3x > -7 - 1$ $-8x > -8$ $-8x < -8$ $\frac{-8}{-8} < \frac{-8}{-8}$ $x < 1$	$\checkmark$ rearranging terms $\checkmark$ simplification $\checkmark$ answer $\checkmark$ number line with all correct values		$\checkmark$ multiplying out brackets $\checkmark$ RHS = 0 $\checkmark$ factorisation $\checkmark$ both answers	(4)
2.3	$(x-3)(x+2) = -6$ $x^2 - x - 6 = -6$ $x^2 - x = 0$ $x(x-1) = 0$ $x = 0 \text{ or } x = 1$	$\checkmark$ Let the breadth be $x$ . Therefore the length is $x + 40$ . $x(x+40) = 1200$ $x^2 + 40x = 1200$ $x^2 + 40x - 1200 = 0$ $(x+60)(x-20) = 0$ $x \neq -60 \text{ or } x = 20$ <p>The length is <math>20 + 40 = 60</math> cm</p>	$\checkmark x(x+40) = 1200$ $\checkmark$ factors: L.H.S. $\checkmark$ both answers and rejecting -60 $\checkmark$ length = 60	$\checkmark$ length is 20 + 40 = 60 cm	(4)

QUESTION 3

$p + q^{-1} = -3$ $(p + q^{-1})^2 = (-3)^2$ $p^2 + 2\frac{p}{q} + q^{-2} = 9$ $6 + 2\frac{p}{q} = 9$ $2\frac{p}{q} = 3$ $\frac{p}{q} = \frac{3}{2}$	$\checkmark$ squaring both sides $\checkmark$ substitution $\checkmark$ answer	3
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QUESTION 4

4.1.1	$(x-y)^0 + \left(\frac{1}{2}\right)^{-2} - 2^5$ $= 1 + 4 - 32$ $= -27$	$\checkmark 1 \checkmark 4 \checkmark -32$ $\checkmark$ answer	(4)
4.1.2	$\frac{6^{-2} \cdot 2^{+2}}{4^+ \cdot 3^{+4}}$ $= \frac{(2 \times 3)^{-2} \cdot 2^{+2}}{(2^2)^+ \cdot 3^{+4}}$ $= \frac{2^{-2} \cdot 3^{-2} \cdot 2^{+2}}{2^{2 \times 2} \cdot 3^{+4}}$ $= \frac{2^{-2+2} \cdot 3^{-2+2}}{2^{4} \cdot 3^{+4}}$ $= \frac{2^0 \cdot 3^0}{2^4 \cdot 3^{+4}} \text{ or } 3^2$ $= 9$	$\checkmark$ prime bases $\checkmark$ application of rules $\checkmark$ simplification $\checkmark$ answer	(4)
4.2.1	$5^x = 1$ $x = 0$	$\checkmark$ answer	(1)
4.2.2	$2^{x+1} - 2^x = 16$ $2^x \cdot 2^1 - 2^x = 2^4$ $2^x(2-1) = 2^4$ $x = 4$	$\checkmark 16 = 2^4$ $\checkmark$ factors $\checkmark$ answer	(3)

**QUESTION 5**

$5^{x-2} = 5^x \cdot 5^{-2}$ $= 25 \left( \frac{1}{25} \right)$ $= 1$ <p style="text-align: center;"><b>OR</b></p> $5^x = 25$ $5^x = 5^2$ $5^{x-2} = 5^{2-2}$ $= 5^0$ $= 1$	<ul style="list-style-type: none"> <li>✓ exponent rule</li> <li>✓ exponent rule</li> <li>✓ answer</li>   <li>✓ prime base</li> <li>✓ -2 from each exponent</li> <li>✓ answer</li> </ul>
<b>3</b>	

**QUESTION 6**

<p>6.1 Irrational number. 45 is not a perfect square.</p>	<ul style="list-style-type: none"> <li>✓ irrational number</li> <li>✓ not a perfect square</li> </ul> <p style="text-align: right;"><b>(2)</b></p>
<p>6.2 The length of a side of the square is <math>\sqrt{45}</math></p> $36 < 45 < 49$ $\sqrt{36} < \sqrt{45} < \sqrt{49}$ $6 < \sqrt{45} < 7$ <p>Therefore the length of the side is between 6 and 7.</p>	<ul style="list-style-type: none"> <li>✓ <math>36 &lt; 45 &lt; 49</math></li> <li>✓ <math>\sqrt{36} &lt; \sqrt{45} &lt; \sqrt{49}</math></li> </ul> <p style="text-align: right;"><b>(2)</b></p>
<b>4</b>	

**TOTAL MARKS: 50**

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