



# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 11**

**MATHEMATICS P1**

**NOVEMBER 2013**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 8 pages.**



**INSTRUCTIONS AND INFORMATION**

Read the following instructions carefully before answering the questions.

1. This question paper consists of 15 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, et cetera that 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 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 Solve for  $x$ :

1.1.1  $3x^2 = 5x + 2$  (4)

1.1.2  $x^2 + 2x - 4 = 0$  (Leave your answer correct to TWO decimal places.) (4)

1.1.3  $x^2 + x - 12 < 0$  (4)

1.2 Simplify, without the use of a calculator, the following expressions fully:

1.2.1  $\left(\frac{125x^7}{x}\right)^{\frac{2}{3}}$  (3)

1.2.2  $(\sqrt{3} + 3)^2 - 2\sqrt{27}$  (4)

1.3 Solve for  $x$  and  $y$  simultaneously:

$$y = x + 2$$

$$xy + y^2 - 10(x + 1) = 0$$
 (6)  
**[25]**

**QUESTION 2**2.1 Given:  $\sqrt{x + 6} = x + 4$ 2.1.1 Calculate  $x$  in the given equation. (5)2.1.2 Hence, or otherwise, write down the solution to  $\sqrt{x + 5} = x + 3$ . (2)2.2 Given:  $f(x) = \frac{3}{\sqrt{3^x - 9}}$ 2.2.1 Determine  $f(3)$ . Leave your answer in simplest surd form. (3)2.2.2 For which value(s) of  $x$  is  $f(x)$  undefined? (3)2.2.3 For which value(s) of  $x$  is  $f(x)$  non-real? (1)  
**[14]**

**QUESTION 3**

The hypotenuse of a right-angled triangle is 25 cm and the length of one other side is  $x$  cm. The perimeter of the triangle is 60 cm.

- 3.1 Show that the third side of the triangle is  $(35 - x)$  cm. (1)
- 3.2 Calculate the lengths of the two shorter sides of the triangle. (5)  
[6]

**QUESTION 4**

Sheena receives R1 500 as a gift. She invests her money in a savings account, earning interest at 15% per annum compounded semi-annually.

- 4.1 How much money does Sheena have in her investment account at the end of 5 years? (4)
- 4.2 Disa also receives R1 500, but she invests her money in an account which earns interest annually. If Sheena and Disa have the same amount of money at the end of 5 years, what annual interest rate is Disa earning? (3)  
[7]

**QUESTION 5**

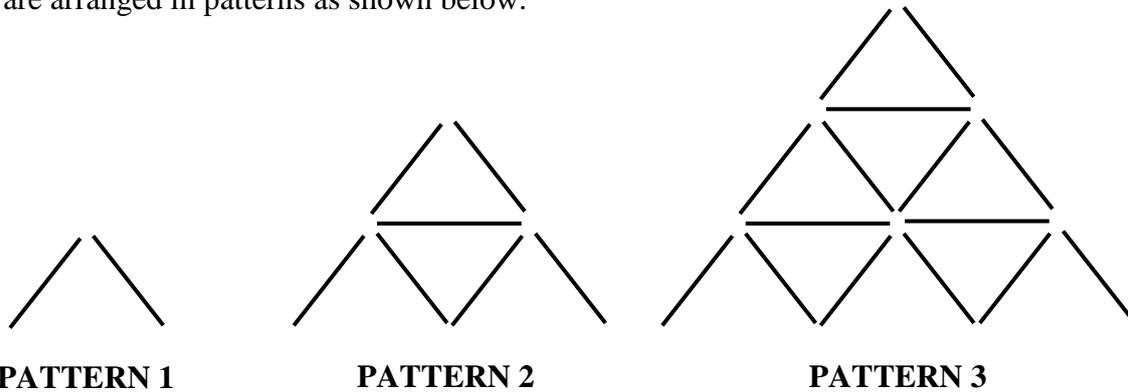
A company bought new machinery for R23 000 at the beginning of 2013. The machinery depreciates on the reducing-balance method at a rate of 13,5% per annum.

- 5.1 Determine the book value of the machinery at the end of 2017. (2)
- 5.2 Determine the expected cost of purchasing new machinery at the beginning of 2018 if the purchase price at the beginning of 2013 increases at 6,6% compounded annually. (2)
- 5.3 How much money would the company have had to invest as a lump sum at the beginning of 2013 if they wanted to pay cash for the new machinery at the beginning of 2018 and the money is invested in a bank account earning interest of 4,7% p.a., compounded monthly? (6)  
[10]



**QUESTION 6**

Sticks are arranged in patterns as shown below.



<b>Pattern number</b>	1	2	3
<b>Number of sticks</b>	2	7	15

- 6.1 Write down the number of sticks needed to build Pattern 4 if the patterns are consistent. (1)
  - 6.2 Determine a formula to calculate the number of sticks needed to build Pattern  $n$ . (4)
  - 6.3 How many sticks would you need to build Pattern 16? (2)
  - 6.4 Calculate the maximum value of  $n$  if you have only 126 sticks available to build Pattern  $n$ . (5)
- [12]**

**QUESTION 7**

Given the number pattern:  $\frac{1}{2}$  ;  $\frac{2}{3}$  ;  $\frac{3}{4}$  ;  $\frac{4}{5}$  ;  $y$  ; ...

- 7.1 Given that the pattern behaves consistently, write down the value of  $y$ . (1)
  - 7.2 Determine a formula for  $T_n$ , the  $n^{\text{th}}$  term of this pattern. (3)
- [4]**

**QUESTION 8**

Two number patterns, the one consisting of uneven numbers and the other consisting of even numbers, are combined to form a new number pattern as shown below.

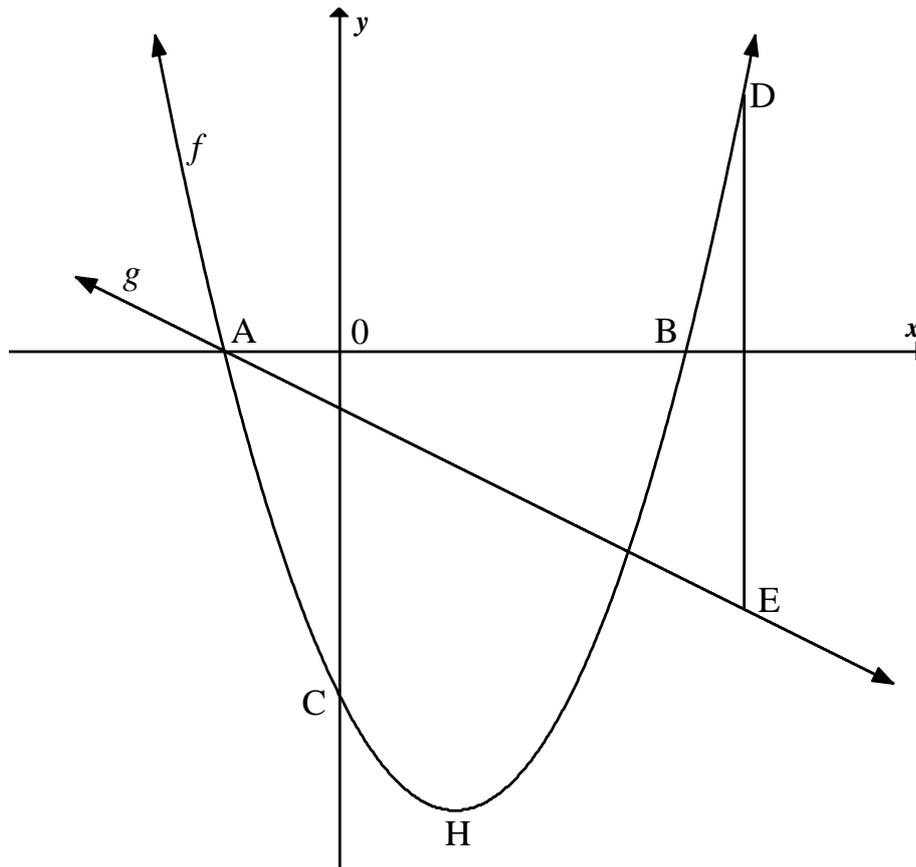
1 ; 2 ; 5 ; 6 ; 9 ; 18 ; 13 ; 54 ; ...

- 8.1 Write down the next TWO terms of the pattern. (2)
  - 8.2 Calculate the 31<sup>st</sup> term of the pattern. (3)
- [5]**



**QUESTION 9**

The sketch below represents the graphs of  $f(x) = x^2 - 2x - 3$  and  $g(x) = mx + c$ .  
 D is a point on  $f$  and E is a point on  $g$  such that DE is parallel to the y-axis.  
 A and B are the x-intercepts of  $f$ .  
 The straight line,  $g$ , passes through point A.  
 H is the turning point of the graph of  $f$ .



- 9.1 Write down the domain of  $g$ . (1)
- 9.2 Determine the length of AB. (3)
- 9.3 Determine the average gradient of  $f$  between A and C. (3)
- 9.4 Determine the coordinates of H, the turning point of  $f$ . (3)
- 9.5 Determine the equation of  $g$ , if the graph of  $g$  is perpendicular to  $y - 2x - 5 = 0$ . (4)
- 9.6 For what values of  $x$  is  $g(x) \cdot f(x) \geq 0$  if  $x > 0$ ? (2)
- 9.7 Determine the positive  $x$ -value for which  $DE = 7,5$  units. (5)
- 9.8 Use the graph to determine for which value(s) of  $k$  will  $f(x) = k$  have non-real roots. (1)

[22]



**QUESTION 10**

Given:  $f(x) = -\left(\frac{1}{4}\right)^x + 4$

- 10.1 Write down an equation of the asymptote of  $f$ . (1)
- 10.2 Determine the coordinates of the  $y$ -intercept of  $f$ . (2)
- 10.3 Determine the coordinates of the  $x$ -intercept of  $f$ . (3)
- 10.4 Sketch a graph of  $y = f(x)$ , clearly indicating the asymptote and the coordinates of all intercepts with the  $x$ - and  $y$ -axes. (4)
- 10.5 If the graph of  $f$  is now reflected in the line  $y = 4$  to create the graph of  $k$ , write down a formula for  $k$  in the form  $y = \dots$  (2)
- [12]**

**QUESTION 11**

Given:  $f(x) = \frac{3}{x+p} + q$

- 11.1 If the asymptotes of  $f$  intersect in the point  $(5 ; 1)$ , determine the values of  $p$  and  $q$ . (2)
- 11.2 The graph of  $f$  is translated 1 unit right and 4 units up to create the graph of  $h$ . Write down an equation for  $h$  in the form  $y = \dots$  (2)
- [4]**

**QUESTION 12**

Given:  $f(x) = ax^2 + bx + c$

$(m - 5)$  and  $(m + 3)$  are roots of  $f$ .  
The maximum value of  $f$  occurs when  $x = 2$ .

- 12.1 Calculate the value of  $m$ . (3)
- 12.2 Determine the equation of  $f$ , in the form  $y = ax^2 + bx + c$ , if it is also given that  $f(1) = 15$ . (5)
- [8]**



**QUESTION 13**

All the students at a certain college undergo annual HIV testing. The results of this year's testing are shown in the table below.

	HIV POSITIVE	HIV NEGATIVE	TOTAL
<b>Male</b>	106	422	<i>b</i>
<b>Female</b>	<i>a</i>	<i>d</i>	<i>c</i>
<b>TOTAL</b>	192	<i>e</i>	960

- 13.1 How many students are there at the college? (1)
- 13.2 Determine the values of *a*, *b*, *c*, *d* and *e*. (5)
- 13.3 Is HIV status independent of gender at this college? Motivate your answer with relevant calculations. (4)
- [10]**

**QUESTION 14**

A retail store did a survey of its customers and found that 30% of the customers were unhappy with the service received. Of those who were unhappy with the service, 74% said that they would not shop at that store again. Of those who were happy with the service, only 5% said that they would not shop at the store again.

- 14.1 Draw a tree diagram to represent the results of this survey, clearly indicating the probability of each overall outcome correct to THREE decimal places. (5)
- 14.2 Determine the probability that a customer selected at random says that he/she will shop at the store again. (2)
- [7]**

**QUESTION 15**

Two independent relay teams want to qualify for the next Olympic Games. The probability that the two teams run under the qualifying time, is  $\frac{4}{9}$  and  $\frac{3}{7}$  respectively. Calculate the probability that one of the relay teams will run under the qualifying time in their next race. (4)

**TOTAL: 150**

