



# basic education

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

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 11**

**TECHNICAL MATHEMATICS P1**

**EXEMPLAR 2017**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 9 pages.**

**INSTRUCTIONS AND INFORMATION**

Read the following instructions carefully before answering the questions.

1. This question paper consists of 9 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).
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 Simplify the following without the use of a calculator:

1.1.1  $\left(\frac{1}{27}\right)^{\frac{1}{3}}$  (2)

1.1.2  $\frac{\sqrt{20} - \sqrt[3]{8}}{\sqrt{5} - 1}$  (4)

1.1.3  $\frac{\sqrt[4]{16x^8}}{\sqrt{81x^2} - \sqrt[3]{64x^3}}$  (5)

1.1.4  $\frac{6^{x+1} \cdot 9^{x-1}}{2^{x+1} \cdot 27^x}$  (4)

1.1.5  $\frac{3^{2x} - 7 \cdot 3^x + 12}{2 \cdot 3^x - 8}$  (3)

1.1.6  $\log_{\frac{1}{2}} 4 + \log_p p - \log_{10} 100$  (4)

1.2 Prove that  $\frac{\log \sqrt{27} + \log \sqrt{8} - \log \sqrt{125}}{\log 6 - \log 5} = \frac{3}{2}$  (6)  
[28]

**QUESTION 2**2.1 Solve for  $x$ :

2.1.1  $3^x + 3^{x-1} = \frac{4}{9}$  (5)

2.1.2  $2^x = 5$  (3)

2.1.3  $\log_4(x-6) + \log_4 x = 2$  (6)

2.2 Given:  $i = \frac{nE}{R + \frac{nr}{m}}$

2.2.1 Hence make  $R$  the subject of the formula. (3)

2.2.2 Determine the value of  $R$  if  $i = 2,3$ ;  $E = 2,4$ ;  $n = 5,6$ ;  $m = 2$  and  $r = 0,4$ . (2)

2.2.3 If  $\log 2 = a$  and  $\log 3 = b$ , determine  $\log 15$  in terms of  $a$  and  $b$ . (3)  
[22]

**QUESTION 3**

3.1 Given:  $g(x) = x^2 - 3x$   
Solve for  $x$  if:

3.1.1  $g(x) = 0$  (3)

3.1.2  $g(x) = 5$  (5)

3.2 Solve for  $x$  if:  $\frac{2x-3}{x-1} = \frac{x+1}{3}$  (4)

3.3 Solve for  $x$  if  $2x^2 - 5x + 3 \leq 0$ , and represent the solution graphically. (5)

3.4 Solve for  $x$  and  $y$  simultaneously in the following equations:

$$y - x - 3 = 0$$

$$x^2 + 4x + y = -1$$
 (7)

3.5 If a heater is used for 2 hours and an electric motor for 4 hours, they consume 25 kJ of energy. If the heater is used for 3 hours and the electric motor for 2 hours, they consume 18 kJ of energy. Calculate the energy consumption per hour of the heater and of the electric motor. (6)  
**[30]**

**QUESTION 4**

4.1 Describe the nature of roots if  $x = \frac{-2 \pm \sqrt{16}}{2}$  (3)

4.2 Determine the nature of roots of the equation  $-4x^2 - 2x + 1 = 0$ , without solving the equation. (5)  
**[8]**

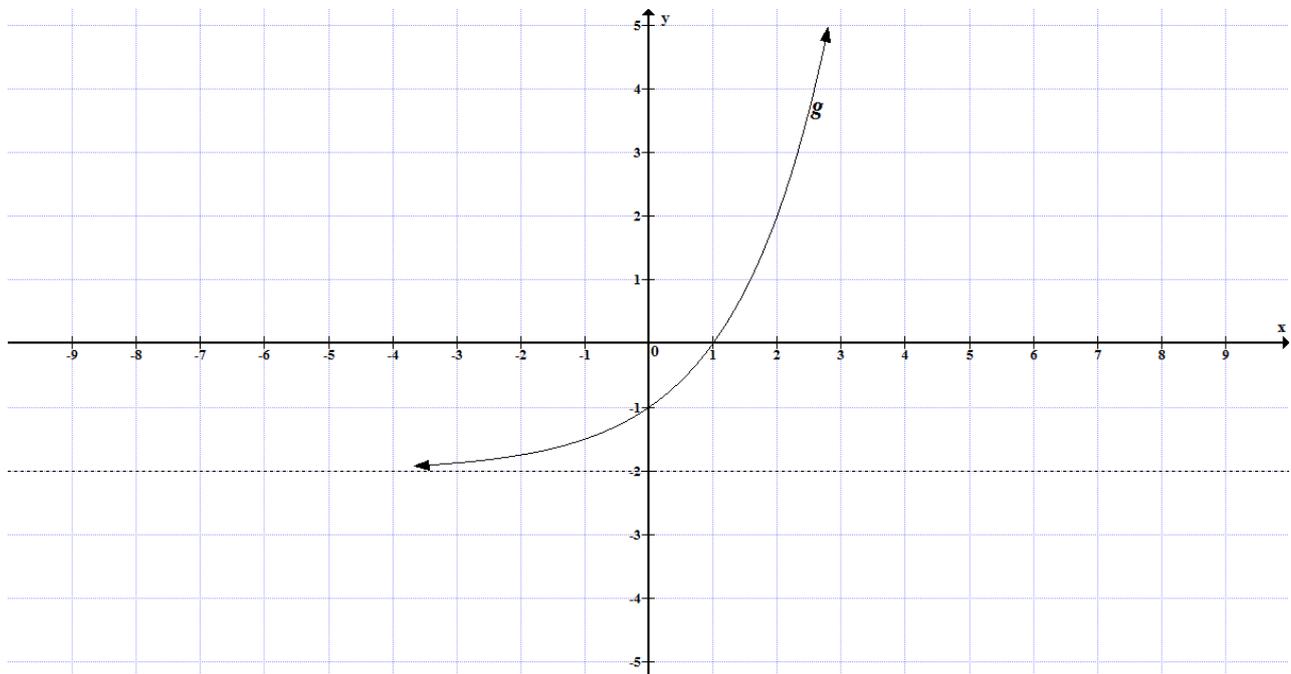
**QUESTION 5**

Given:  $f(x) = -\frac{2}{x} + 2$  and a circle,  $x^2 + y^2 = 9$

- 5.1 Write down the equations of the asymptotes of  $f(x)$ . (2)
  - 5.2 Determine the coordinates of the  $x$ - and  $y$ -intercepts of  $f(x)$ . (4)
  - 5.3 Determine the radius of the circle. (2)
  - 5.4 Sketch the circle and the graph of  $f(x)$  on the same system, indicating all the asymptotes and the intercepts with the axes. (5)
  - 5.5 Determine the equation of the line of symmetry of  $f(x)$ , with a negative gradient. (3)
  - 5.6 What is the range of  $f(x)$ ? (2)
  - 5.7 Give the domain of the circle. (1)
- [19]**

**QUESTION 6**

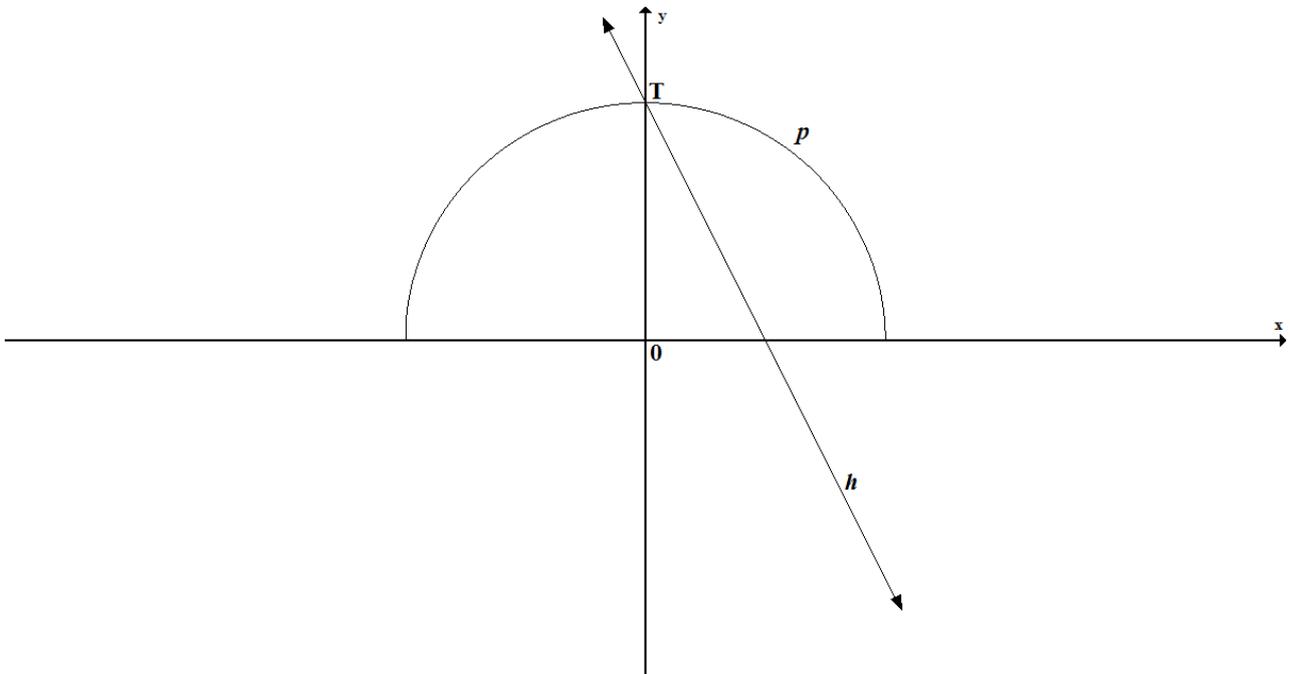
The graph below represents the function  $g(x) = a \cdot 2^x + q$ .



- 6.1 Determine the values of  $a$  and  $q$ . Hence write down the equation of  $g$ . (4)
  - 6.2 Write down the domain of  $g$ . (1)
  - 6.3 For what value(s) of  $x$  is  $g(x) > 0$ ? (1)
- [6]**

**QUESTION 7**

In the diagram below, the graphs of the straight line defined by  $h(x) = -2x + 3$  and the semi-circle  $p$ , having the centre as the origin, intersect at the point T on the y-axis.

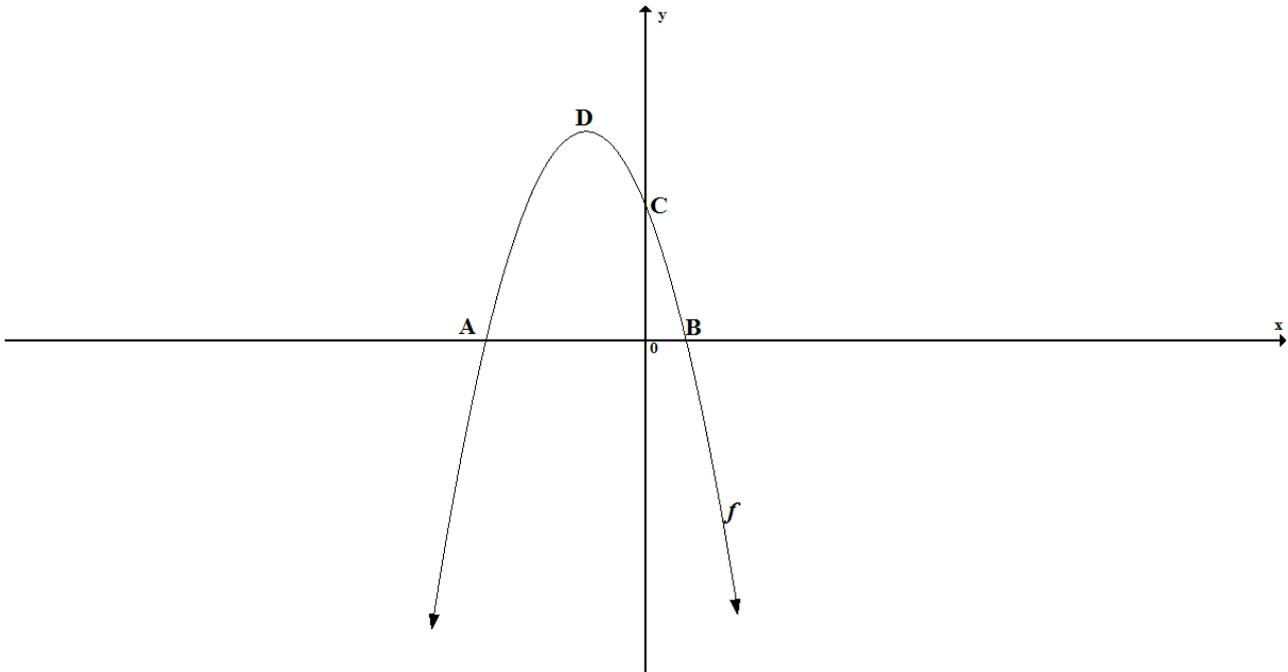


Determine:

- 7.1 The equation of  $p(x)$ , the semi-circle (3)
  - 7.2 The domain of  $p(x)$  (2)
  - 7.3 The  $x$ -intercept of  $h$  (2)
  - 7.4 The values of  $x$ , for which:
    - 7.4.1  $h(x) = p(x)$ . (1)
    - 7.4.2  $h(x) \cdot p(x) \leq 0$  (2)
- [10]**

**QUESTION 8**

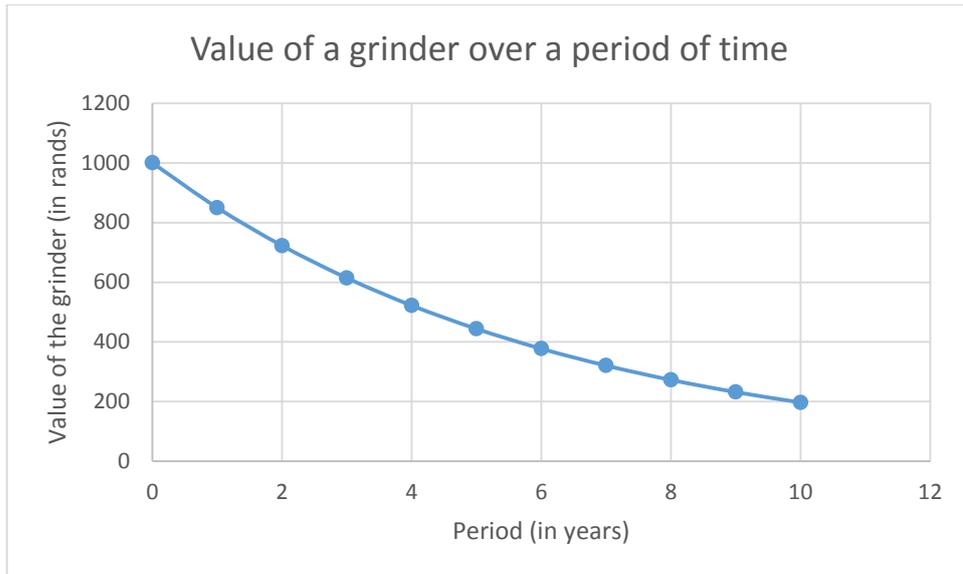
The graph below represents  $f(x) = -2x^2 - 3x + 2$ . The points A, B and C are the intercepts with the axes of  $f(x)$ . D is the turning point of  $f(x)$ .



- 8.1 Calculate the length of AB. (5)
- 8.2 Write down the coordinates of C. (2)
- 8.3 Determine the co-ordinates of the turning point  $f(x)$ . (4)
- 8.4 Write down the maximum value of  $f(x)$ . (1)
- [12]**

**QUESTION 9**

- 9.1 The value of a welding machine depreciates at 10,6% nominal interest per annum, compounded quarterly according to the straight-line method. Calculate the effective interest rate. (4)
- 9.2 The graph below represents the value of a grinder over a period of time, where the  $y$ -axis represents the value of the grinder in rands and the  $x$ -axis represents the period of time in years.



- 9.2.1 What is the initial price of the grinder? (1)
- 9.2.2 Is the grinder appreciating or depreciating in value? Explain your answer. (2)
- 9.2.3 Calculate the rate (in %) compounded annually after 10 years if the value of the grinder is R196,87. (4)
- 9.3 Mr Boyoyo invests R5 200 at a financial institution for 6 years. The interest earned on the investment is 9,4% per annum, compounded annually for the first 4 years, and 8% per annum, compounded quarterly for the remaining years. How much will Mr Boyoyo receive at the end of the investment period? (4)

**[15]**

**TOTAL: 150**