MATHS PAPER 1 QUESTIONS

QUESTION 1

1.1 Solve for x in the following, correct to two decimal places where necessary.

1.1.1 $2x^2 + 7x = 30$ (4)

1.1.2 $2x(x-2) - 5 = 0$ (4)

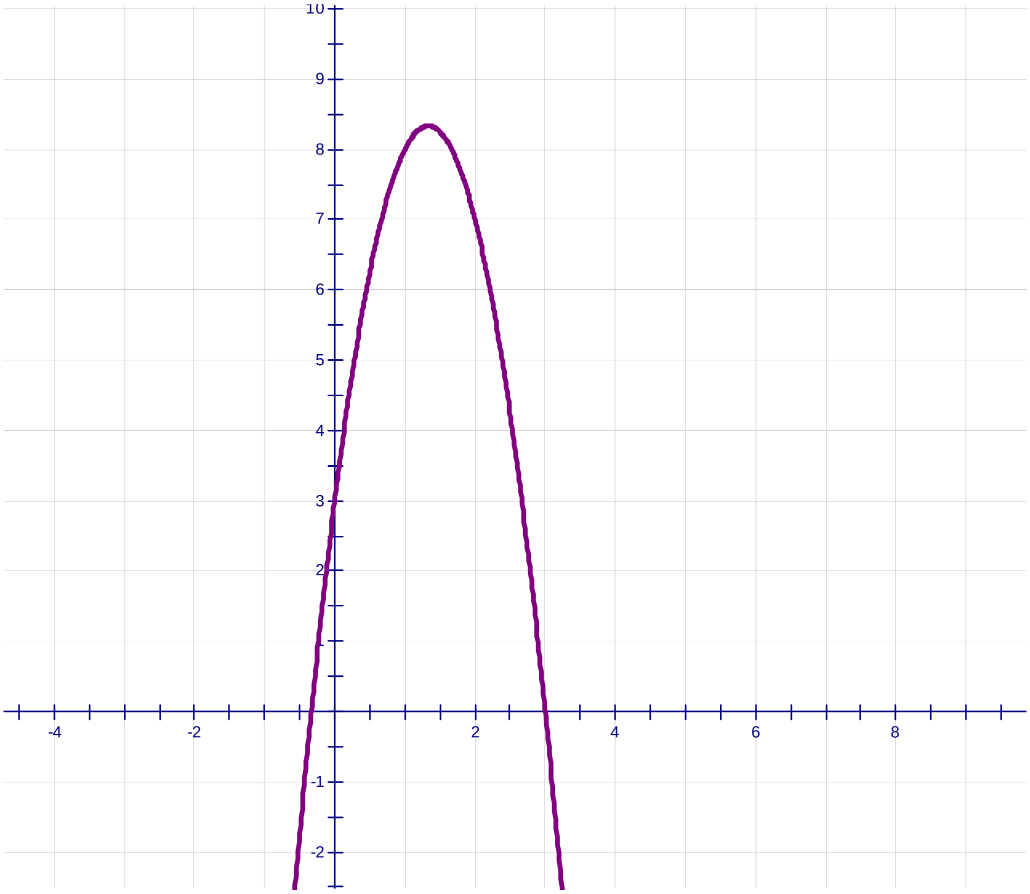
1.1.3 $4x^2 + 7x - 2 < 0$ (4)

1.2

1.2.1 Solve simultaneously for x and y if
$2x + 6 - y = 0$ and $y + 3x^2 = 8x + 3$. (5)

1.2.2 The graph of $y = -3x^2 + 8x + 3$ is shown below. Use this graph and any other sketch to explain your answer in 1.2.1. (3)

[20]


10
9
8
7
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-1
-2
-4
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8

QUESTION 2

2.1 A woman wants to borrow R800 000 in start-up capital for her business. She is offered an interest rate of 9% per annum, compounded monthly, by All Star Finance. She has worked out that she will be able to afford a monthly repayment of R7 500. Determine how long it will take her to pay back the loan. Give your answer in years. (7)

2.2 A bus company owns vehicles to the value of R1 500 000.

2.2.1 The vehicles are depreciating at a rate of 18% per annum on a reducing balance. Calculate their market value after 5 years. (3)

2.2.2 The average rate of inflation over the next five years is expected to be 4,5% per annum and management expects to sell the old vehicles for their market value in 5 years' time. Calculate the value of the sinking fund which will be necessary to buy brand new vehicles after 5 years. (4)

2.2.3 What monthly payments will the management of the bus company need to make in order to achieve this target if they are offered an interest rate of 6% per annum, compounded monthly, on their savings? (5)

[19]

QUESTION 3

3.1 A pyramid of odd numbers has been made, starting with the number 9.

9
11 13
15 17 19
21 23 25 27
29 31 33 35 37

Consider the sequence formed by the numbers at the beginning of each row, that is:

9 11 15 21 29

3.1.1 Give the name of the type of sequence formed. (1)

3.1.2 If the sequence is continued, determine a formula for the nth term. (4)

3.2 Bill and Bob decided to have a competition with their jumping frogs, Sammy and Solly. They recorded the results of the jumps in a table and realised that these results form an arithmetic progression. Jumps are measured in centimetres.

Frog	Jump 1	Jump 4	Jump 20
Sammy	2	17	x
Solly	y	59	107

Determine the values of x and y, showing all workings. (6)

[11]

QUESTION 4

4.1 Anele started working in 2009. His initial annual salary was R85 000. His contract states that he will receive an increase of 9% per year.

4.1.1 Calculate his annual salary for 2010 and for 2011. (2)

4.1.2 His company decides to give a maximum of only 15 salary increases. What is the maximum annual salary that Anele can ever earn under this system? (4)

4.2 Evaluate $\sum_{k=0}^{3} \frac{2}{5^k}$. (3)

4.3 A mining company is drilling a well to reach water at a depth of 95 m below the surface. On the first day of drilling the drill reaches a depth of 20 m. The rock becomes progressively harder and the drill is able to reach only ¾ of the depth of the previous day's drilling on each successive day.

4.3.1 How deep is the hole after 10 days of drilling? (3)

4.3.2 When will the company succeed in reaching the water? Justify your answer by calculation. (4)

[16]

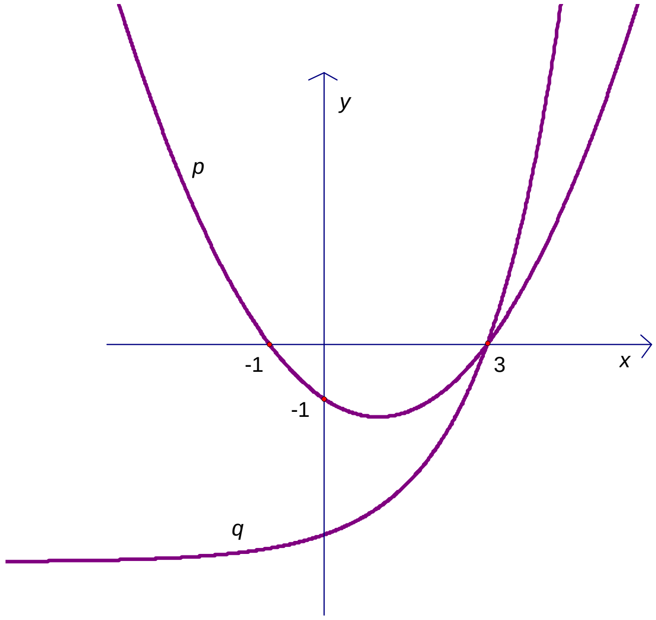
QUESTION 5

5.1 The function $f(x) = \frac{-3}{x-1} + 2$ is given.

5.1.1 Draw a neat sketch graph of the function, showing any intercepts with the axes and any asymptotes. (4)

5.1.2 Determine the equations of the axes of symmetry of $f(x)$. (3)

5.2 Two graphs, $p(x)$ and $q(x)$, are shown in the diagram below.



$p(x)$ passes through the points (–1; 0), (3; 0) and (0; –1).

5.2.1 Determine the equation of $p(x)$ in the form: (5)

$$p(x) = ax^2 + bx + c$$

5.2.2 $q(x)$ passes through (3; 0) and has equation: (2)

$$q(x) = \frac{1}{2}b^x - 4$$

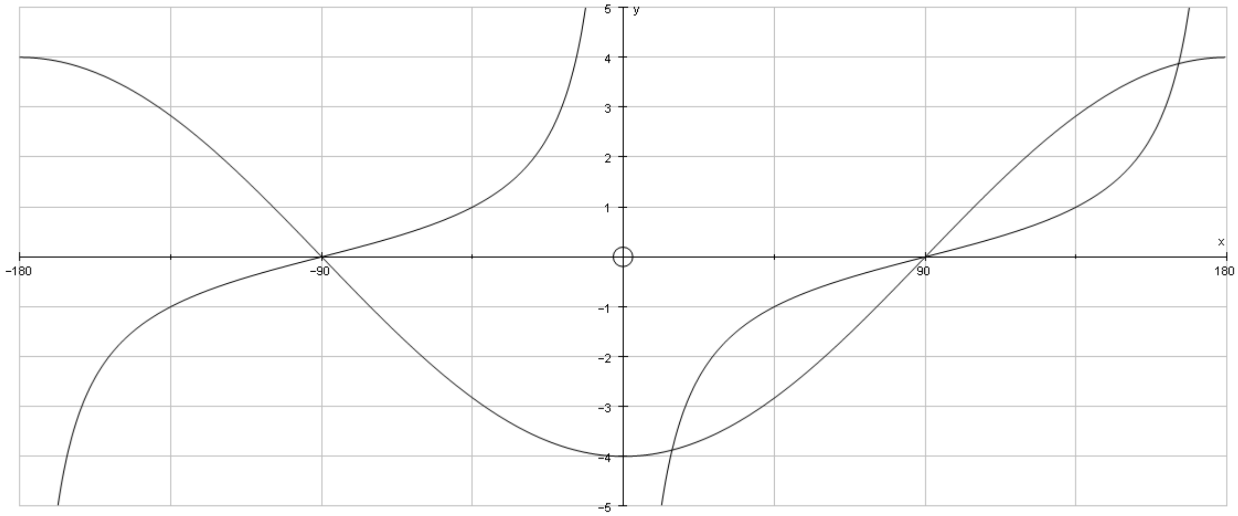
Show that the value of b is 2.

5.2.3 Give the domain and range of $q(x)$. (2)

5.2.4 Determine the equation of $q^{-1}(x)$, the inverse function of $q(x)$. (3)

5.2.5 Give the domain of $q^{-1}(x)$. (1)

5.3 The graphs of $f : y = a\cos x$ and $g : y = \tan(x + 90°)$ are drawn below.



5.3.1 Determine the value of *a*. (1)

5.3.2 Give the equation of the asymptotes of *g* for the domain $-180° \leq x \leq 180°$. (2)

5.3.3 If the graph of *g* is moved 45° to the left and 2 units up, give the equation of the new graph formed. (2)

[25]

QUESTION 6

6.1 From first principles, find the derivative of $f(x) = \frac{1}{2}x^2$. (5)

6.2 Determine

6.2.1 $f'(x)$ if $f(x) = x^4 + \sqrt{x} - \frac{9}{x}$ (3)

6.2.2 $\frac{dy}{dx}$ if $y = t(t+1)$ and $t = 3x$. (3)

6.3 Researchers have been studying the growth of an alien plant in farm dams. The equation $A(x) = -\frac{1}{2}x^3 + 12x^2$ describes the area covered by the plant after x months have passed. The area is measured in square metres.
Determine

6.3.1 how many months the plant will take to cover the maximum area (4)

6.3.2 at what rate the growth was increasing one month after the study had begun. (2)

[17]

QUESTION 7

The function $f(x) = x^3 - 4x^2 - 3x + 18$ is given.

7.1 Find the value of $f(3)$. (1)

7.2 Hence, or otherwise, determine the coordinates of the x-intercepts of the graph of the function. (4)

7.3 Determine the coordinates of any turning points of the graph. (5)

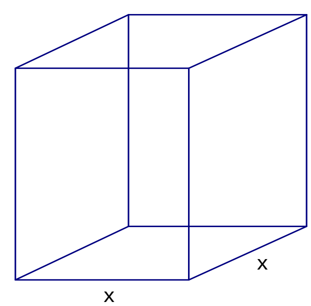
7.4 Draw a clear sketch graph of $f(x)$, showing the intercepts with the axes and any turning points. (4)

7.5 Determine the x-coordinate of the point of inflection of the curve. (2)

[16]

QUESTION 8

A manufacturer wants to make an **open** box (i.e. the box has **no** lid) with a square base and volume 2,5 m^3. The sides are perpendicular to the base and measure x metres each.



8.1 Determine the height of the box in terms of x. (2)

8.2 The manufacturer wants to dip the box in plastic resin to coat the inside and the outside of the box, including the base, with plastic resin. Show that the area to be coated is given by the equation:

$$A = 2x^2 + \frac{20}{x}$$

(3)

8.3 Hence determine the value of x that will give the minimum surface area to be coated. (5)

[10]

QUESTION 9

A retailer wants to buy a maximum of 20 guitars. He can buy either type A for R1 500 each or type B for R3 000 each. R45 000 has been set aside for purchasing all the guitars. At least six of each type must be purchased.

9.1 If the retailer buys x guitars of type A and y guitars of type B, write down four inequalities which describe the above constraints. (4)

9.2 Graphically represent the constraints and clearly indicate the feasible region for the problem. (5)

9.3 If the retailer makes a profit of R400 on each type A guitar and a profit of R1 000 on each type B guitar, write down an equation for the total profit (P) which will be gained on sales. (1)

9.4 Determine how many of each type of guitar should be sold to achieve the maximum profit. (3)

9.5 If the profit on type A changes to R500 and the profit on type B remains the same, explain how this will affect the quantity of each type that should be sold to achieve the maximum profit. (3)

[16]