Mathematics
Paper 1

FORM 4
6 June 2018
Session 1

TIME: 2 hours	TOTAL: 100 marks
Examiner: Miss M. Eastes	**Moderator: Mrs. D. Algie**

NAME AND SURNAME:

TEACHER:

<u>**PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY BEFORE ANSWERING THE QUESTIONS.**</u>

- This question paper consists of 15 pages. Formulae are given on page 2.
  Please check that your question paper is complete.

- <u>Answer all questions on your question paper.</u>

- Read and answer all questions carefully.

- It is in your own interest to write legibly and to present your work neatly.

- All necessary working which you have used in determining your answers **must** be clearly shown.

- Approved non-programmable calculators may be used except where otherwise stated. Where necessary give answers correct to **2 decimal places** unless otherwise stated.

- Ensure that your calculator is in DEGREE mode.

- Diagrams have not necessarily been drawn to scale.

- State all restrictions where necessary.

Questions	1	2	3	4	5	6
Out of	27	6	9	5	5	12
Mark						
Question	**7**	**8**	**9**	**10**	**11**	**TOTAL**
Out of	4	5	18	4	5	100
Mark						

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad T_n = a + (n-1)d$$

QUESTION 1 [27]

Solve for x without using the calculator:
(you can use the calculator to check your answers if necessary)

a) $x(3x - 1) = 2$; $x \in Z$ (4)

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b) $\frac{1}{x+1} + \frac{3}{x-2} = \frac{x+2}{x+1}$ (6)

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c) $2^{-2x} = \frac{1}{32}$ (3)

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d) $x + \sqrt{x - 2} = 4$ (5)

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e) $5x^{\frac{-2}{3}} = 80$ (5)

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f) $x^2 - 3x + 2 \geq 0$ (4)

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QUESTION 2 [6]

Consider the sequence   - 5; - 2; 1; 4; 7; …

a) Write down the next two terms of this sequence.   (2)

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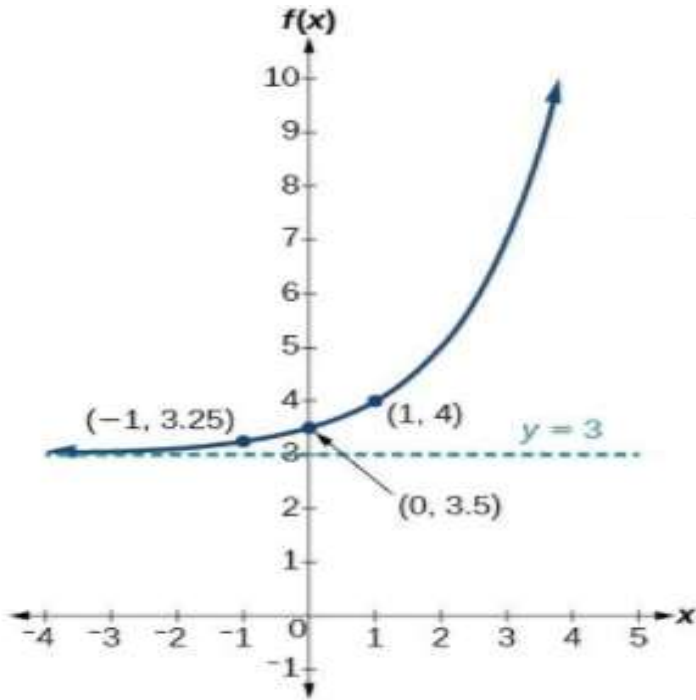b) Determine the formula of the nth term of this sequence in its simplest form.   (2)

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c) Determine the value of the 25th term.   (2)

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QUESTION 3 [9]

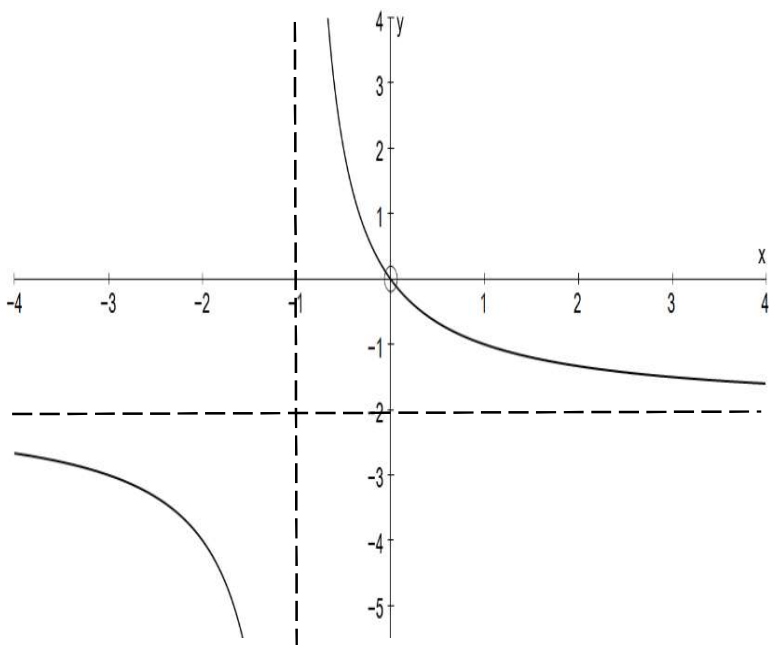Determine the equations of the following graphs:

a) $y = 2^{x-p} + q$ (5)

b) $f(x) = \dfrac{a}{x+p} + q$ (4)

SECTION B

QUESTION 4 [5]

Solve for x: $\sqrt{4^{x+1} + 2^{2x+5}} = 3.2^{2-x}$ (5)

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QUESTION 5 [5]

A pupil solves a quadratic equation by using the quadratic formula.

Her solution is: $x = \dfrac{-5 \pm \sqrt{25 - p^2}}{2}$

a) For which value(s) of p will the roots be equal? (2)

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b) Discuss the nature of the roots if p = -3. (3)

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QUESTION 6 [12]

Without using a calculator, simplify:

a) $\dfrac{3^x - 3^{x-2}}{6.3^x - 4.3^{x-2}}$ (5)

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b) $\dfrac{\sqrt[3]{(a-b)^3} \times \sqrt[3]{(a-b)^3}}{a^2 - b^2}$ (3)

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c) $\left(16^{\frac{1}{4}} + 32^{-\frac{2}{5}}\right)^{\frac{1}{2}}$ (4)

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QUESTION 7 [4]

For which real values of k does the following function have real roots?
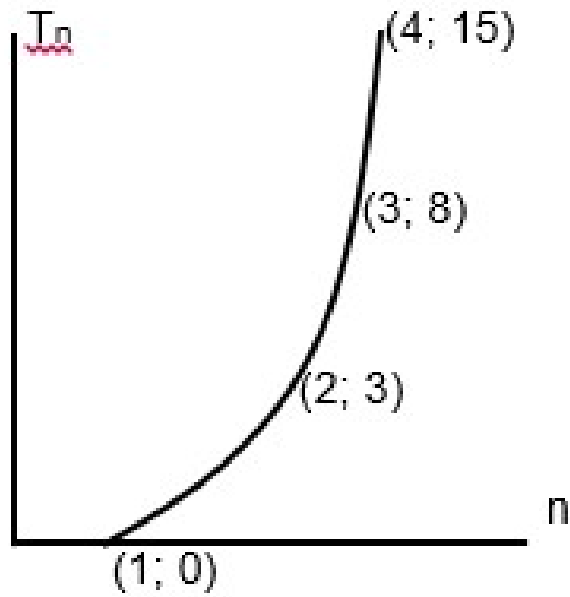
$2x^2 - 8x + 6 = k$ (4)

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QUESTION 8 [5]

The graph below depicts the relationship between n and T_n.

Determine the general term. (Tn in terms of n)   (5)

The graph shows points (1; 0), (2; 3), (3; 8), (4; 15) on a curve, with T_n on the vertical axis and n on the horizontal axis.

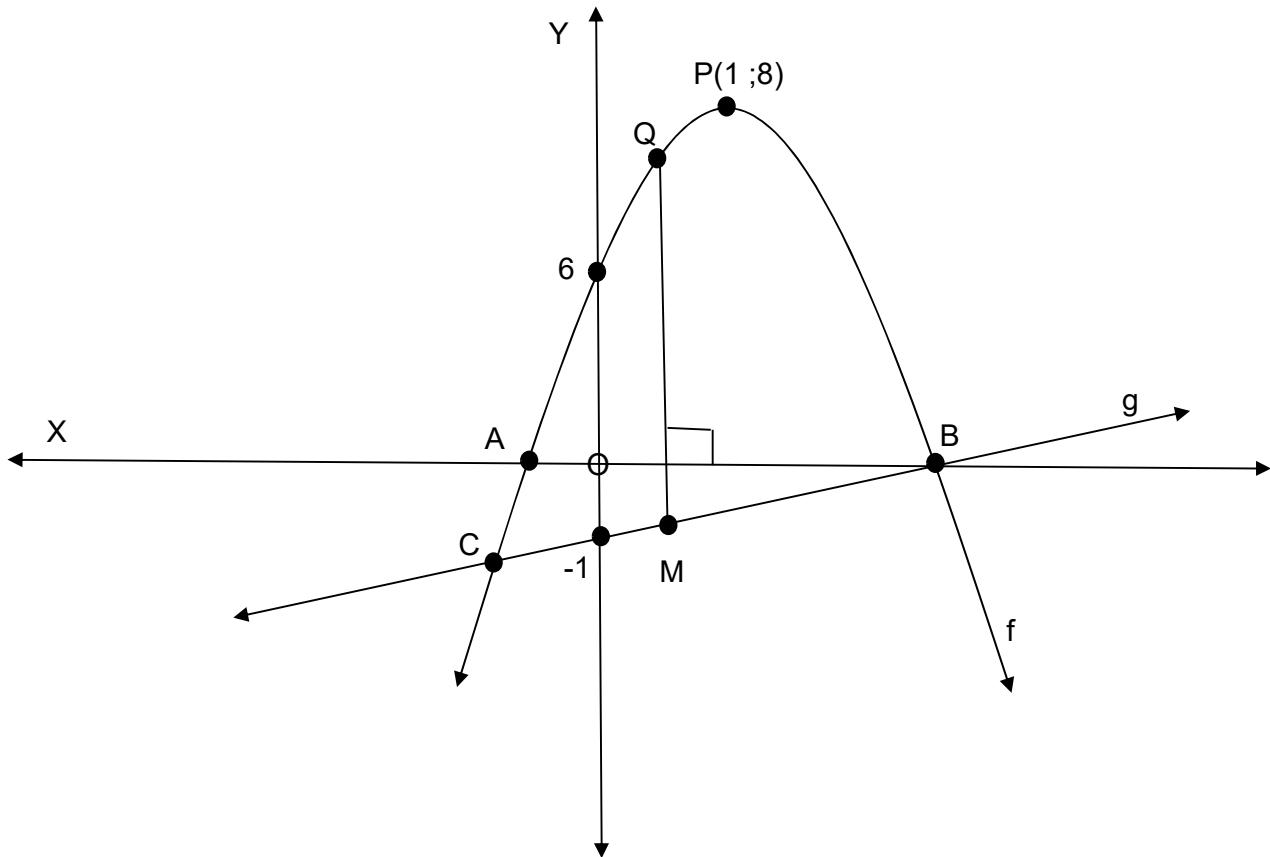_____

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QUESTION 9 [18]

Below is a sketch graph of a parabola, *f*, and a straight line, *g*.
P(1; 8) is the turning point of *f*.

$g(x) = \dfrac{1}{3}x - 1$

The graph of *f* cuts the y-axis at (0;6), g cuts the y-axis at (0;-1).
B is a point on the x-axis and QM is perpendicular to the x-axis.

a) Show that $f(x) = -2x^2 + 4x + 6$ (4)

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b) Determine the coordinates of point C (6)

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c) Determine the maximum length of QM between the graph of *f and g*. QM $\perp$ AB. (5)

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d) Find values of x for which: $f(x).g(x) > 0$ (3)

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QUESTION 10 [4]

$p(x) = ax^2 + bx + c$. You are given the following information about *p*:

- the roots differ by 6

- the value of x = $\dfrac{-b}{2a}$ is 3.

- The range is y ≤ 4.

Draw a sketch graph of p below, indicating the x-intercepts and the co-ordinates of the turning point.   (4)

QUESTION 11 [5]

One of our soccer players kicks the ball so that it follows the path described by the equation

$$h = \frac{-1}{20}(d - 15)^2 + \frac{45}{4},$$

where h is the height and d is the horizontal distance, in metres.

She claims that she can kick the ball a horizontal distance of 40m.

Is that true?

Prove your answer by showing all calculations. (5)

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EXTRA PAPER FOR WORKING IF NEEDED