Name :	Index no:	Class:	Calculator Model:

DEYI SECONDARY SCHOOL

Mid-Year Examination 2018

Secondary Three Express

ADDITIONAL MATHEMATICS 4047

03 May 2018
1100 – 1300h
2 hours

Additional Materials: Writing Papers (6 sheets)

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.
Write your calculator model on the top right-hand corner of the first page of your answer script.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid/tape.

Answer **all** the questions.
Write your answers on the separate writing paper or graph paper provided.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an approved scientific calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, arrange all your answer scripts in order of the questions answered and fasten them together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is **80**.

1 The mass, m grams, of a radioactive element, present at time, t days, after first being observed, is given by the formula $m = 42e^{-0.02t}$.

Find

(i) the initial mass of the radioactive substance, [1]

(ii) the amount of substance remaining after 45 days. [1]

(iii) **Hence**, sketch the graph of $m = 42e^{-0.02t}$. [2]

2 Find the range of values of c for which the line $y = x + c$ intersects the curve $2x^2 - 4xy + y^2 = 8$ at two real and distinct points. [4]

3 Express $\frac{2x}{(2x-1)(2x+1)^2}$ in partial fractions. [4]

4 Given that angle $ABC = 90°$, $AB = \left(3\sqrt{2} + \sqrt{5}\right)$ m and Area of $\Delta ABC = (8 + \frac{7}{2}\sqrt{10})$ m^2.

Without using a calculator, leaving your answers in surd form,

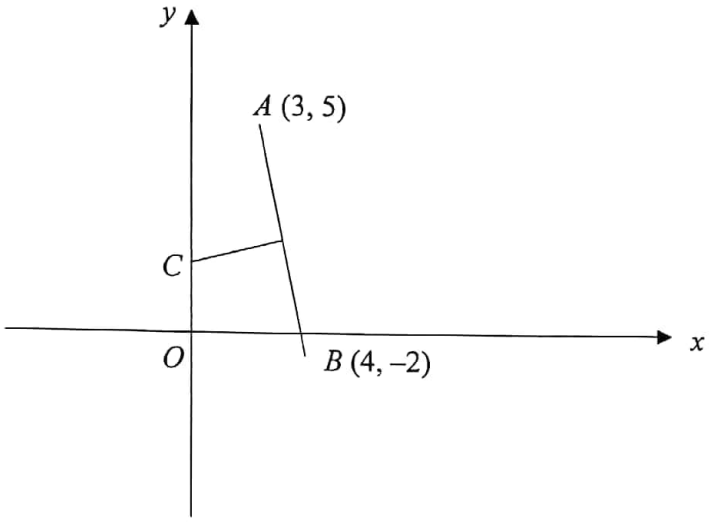
(i) show that $BC = \left(\sqrt{2} + 2\sqrt{5}\right)$ m. [2]

(ii) Find the value of AC^2. [2]

5 The line $2y - x = 3$ meets the curve $x^2 - xy - y^2 = 1$ at points P and Q.

Find the midpoint of PQ. [5]

6 **Solutions to this question by accurate drawing will not be accepted.**



Given that A is (3, 5) and B is (4, −2), find

(i) the equation of the perpendicular bisector of AB, [4]

(ii) the coordinates of C, where it lies on the perpendicular bisector of AB. [1]

7 **(i)** On the same diagram, sketch the graph of $y = \frac{1}{10}x^{\frac{3}{2}}$ and $y = 5x^{-\frac{3}{2}}$ for $x \geq 0$. [4]

(ii) Calculate the coordinates of the point of intersection of your graphs, leaving your answers in the exact form. [2]

8 The roots of the equation $3x^2 - 4x + 6 = 0$ are α and β.

Find

(i) the value of $\alpha^2 + \beta^2$, [3]

(ii) the quadratic equation whose roots are $\frac{2}{\alpha^2}$ and $\frac{2}{\beta^2}$. [3]

9 Find the range of values of x for which $2x - 1 \leq x^2 - 4 < 12$. [6]

10 Solve the simultaneous equations

$$81^{\left(\frac{3}{2}-x\right)} - 3^y = 0,$$

$$4^{3x} \times 16^{(y-2)} = 64.$$ [6]

11 **(i)** Solve the equation $|x + 3| = 3 - \frac{1}{2}x$. [3]

(ii) Hence, sketch the graphs of $y = |x + 3|$ and $y = 3 - \frac{1}{2}x$ on the same axes for the interval $-14 \leq x \leq 0$. [4]

12 The polynomial $2x^3 + ax^2 + bx - 12$ is exactly divisible by $x^2 + 3x - 4$.

Find the value of a and of b. [7]

13 **(a)** Simplify $7\sqrt{98} + 2\sqrt{50} - \frac{24}{\sqrt{8}}$. [3]

(b) Solve the equation $25^y + 5 = 126(5^{y-1})$. [4]

14 The cubic polynomial $f(x)$ is such that the coefficient of x^3 is 1 and the roots of $f(x) = 0$ are 1, k and k^2. It is given that $f(x)$ has a remainder of 7 when divided by $x - 2$.

(i) Show that $k^3 - 2k^2 - 2k - 3 = 0$. [3]

(ii) Factorise $g(k) = k^3 - 2k^2 - 2k - 3$. [2]

(iii) Show that $g(k) = k^3 - 2k^2 - 2k - 3$ has only one real root for all real values of k. [4]

~ End of Paper ~