中正中学(义顺)
CHUNG CHENG HIGH SCHOOL (YISHUN)

Mid-Year Examination (2019)
Secondary 4 Express / 5 Normal (Academic)

Candidate Name		Register No	Class

Additional Mathematics Paper 1
4047 / 1

Date : 13th May 2019

Duration : 2 hours

For examiner's use
/ 80

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** the questions.

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.

The number of marks is given in brackets [ ] at the end of each question or part question. The total marks for this paper is 80.

Setter : Poh Eng Hua Terence

This paper consists of **17** printed pages, INCLUDING the cover page. **[Turn over**

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$, $\quad x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Binomial Expansion

$$(a+b)^n = a^n + \binom{n}{1} a^{n-1}b + \binom{n}{2} a^{n-2}b^2 + \cdots + \binom{n}{r} a^{n-r}b^r + \cdots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \dfrac{n!}{r!(n-r)!} = \dfrac{n(n-1)\cdots(n-r+1)}{r!}$

2. Trigonometry

Identities

$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$
$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$
$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$
$$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$$
$$\sin 2A = 2 \sin A \cos A$$
$$\cos 2A = \cos^2 A - \sin^2 A = 2\cos^2 A - 1 = 1 - 2\sin^2 A$$
$$\tan 2A = \frac{2\tan A}{1 - \tan^2 A}$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

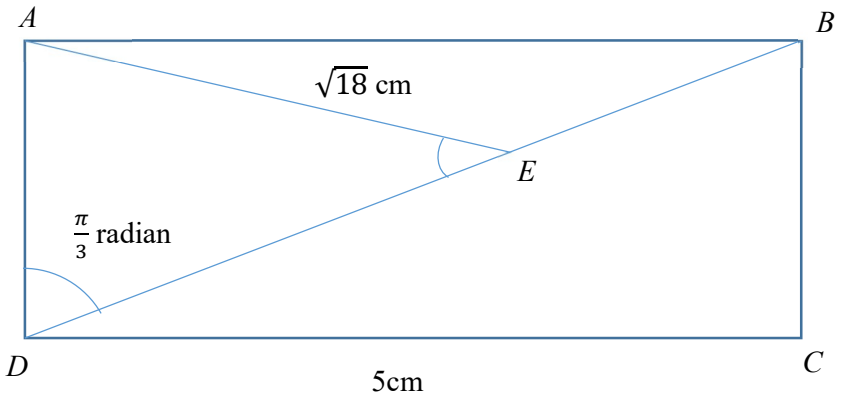
$$a^2 = b^2 + c^2 - 2bc\cos A$$
$$\text{area of } \Delta ABC = \frac{1}{2}ab\sin C$$

1. (i) Show that $4|4x - 6| - 2|9 - 6x| = k|2x - 3|$, where k is a constant. [2]

(ii) Hence, find x when $k|2x - 3| = 5$. [2]

2. A curve has an equation of $y = 2x^2 - 4x + c$ where c is a constant. Find the range of values of c for which line $y = 2x + 1$ intersects the curve at 2 distinct points. [3]

3. Given that rectangle $ABCD$ has side $CD = 5$ cm, $AE = \sqrt{18}$ cm and $\angle ADB = \frac{\pi}{3}$ radian, show that $\angle AED = \sin^{-1}\frac{5}{12}\sqrt{2}$ radian. [3]



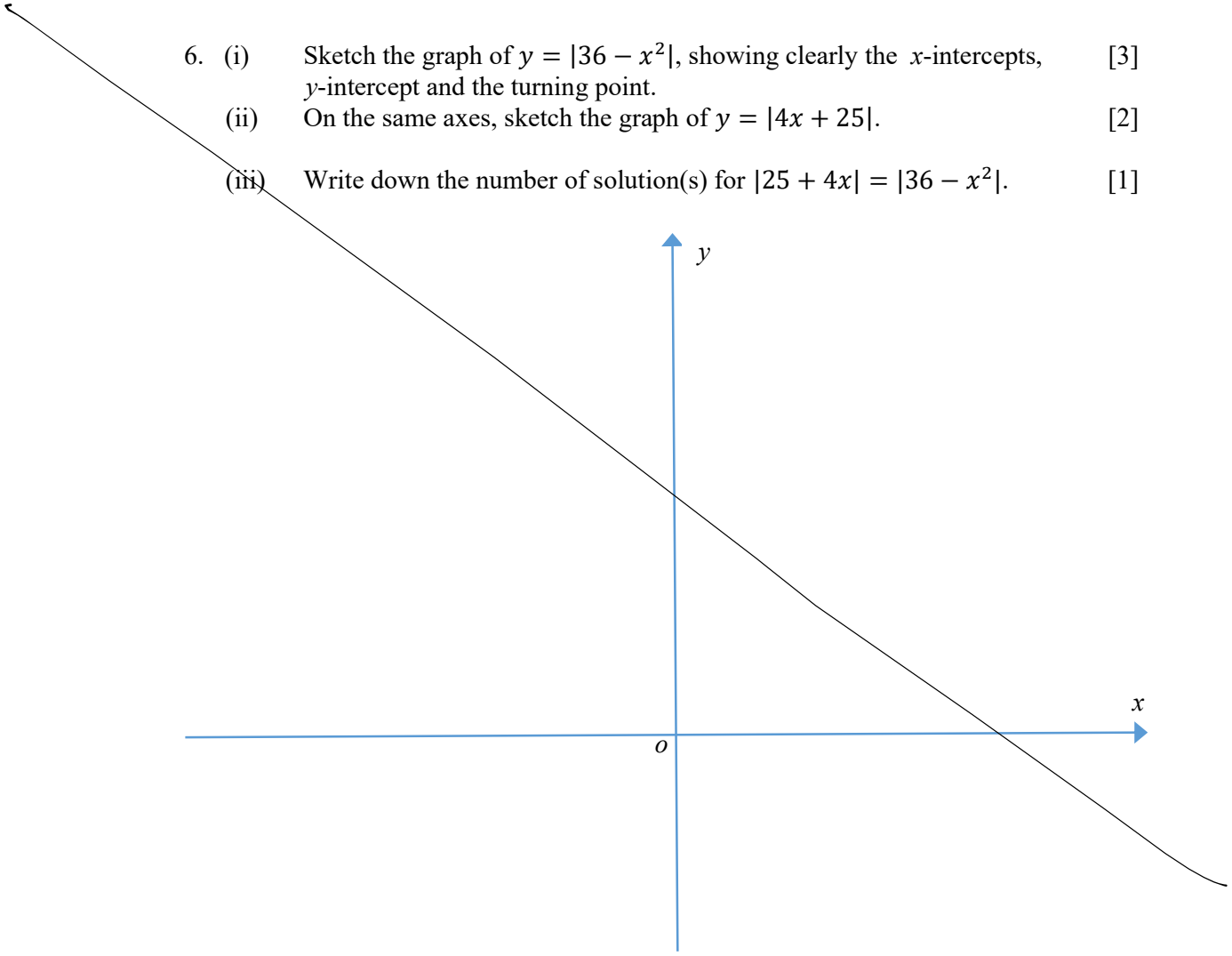
4. $\frac{7}{\sqrt{7}-\sqrt{2}} - \frac{1}{\sqrt{7}}$ can be expressed as $a\sqrt{2} + b\sqrt{7}$. Find the value of a and b where a and b are rational numbers. [3]

5. $2x^2 - x - 1$ is a factor of $2x^4 - 7x^3 + ax^2 + 13x + b$. Find the value of a and of b. [6]

6. (i) Sketch the graph of $y = |36 - x^2|$, showing clearly the x-intercepts, y-intercept and the turning point. [3]

(ii) On the same axes, sketch the graph of $y = |4x + 25|$. [2]

(iii) Write down the number of solution(s) for $|25 + 4x| = |36 - x^2|$. [1]



7. A, B and C are vertices of a triangle and coordinates of A and B are (1, 5) and (4, 1) respectively. The perpendicular bisector of AB cut the x-axis at C. Find

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

(ii) the area of triangle ABC. [3]

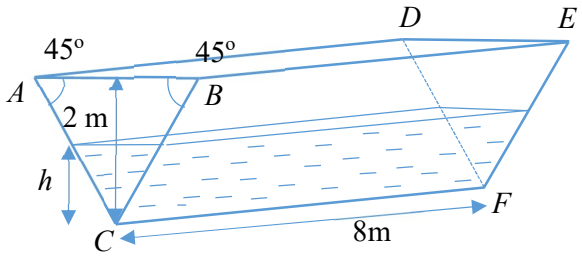
8. $\mathrm{f}(x) = 3 - \sin 2x$ is defined for $0 \leq x \leq 2\pi$.

(i) State the amplitude and period of $\mathrm{f}(x)$. [2]

(ii) Sketch graph of $y = \mathrm{f}(x)$ for $0 \leq x \leq 2\pi$, showing clearly the turning points and the intercepts with $y = 3$. [3]

(iii) Solve $2.5 = 3 - \sin 2x$ for $0 \leq x \leq 2\pi$. [4]

9. The cross-section of a trough *ABCDEF* is an isosceles triangle with height 2 m and base angle 45°. The length of the trough is 8 m.



The trough *ABCDEF* is initially filled to the brim with water. Due to a leak, the height of the water level is dropping at a constant rate of 0.25 m/s.

(i) Show that the volume (V) of water in the trough is given by $V = 8h^2$, where h is the height of water in the trough. [4]

(ii) Find the rate of change of h when $V = 24\ \text{m}^3$. [4]

10. (a) Solve the equation $2 + 2\log_3(1 - x) = \log_9 256$. [5]

(b) By using appropriate substitution, solve the equation
$4^x + 2^{x+3} = 33$ [4]

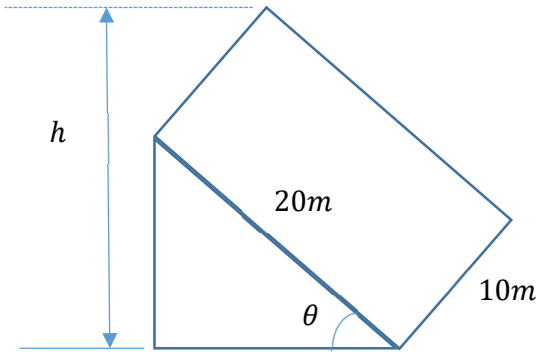
11. (i) Factorise completely the cubic polynomial $2x^3 + 9x^2 + 13x + 6$. [4]

(ii) Express $\frac{5x^2-3}{2x^3+9x^2+13x+}$ as the sum of 3 partial fractions. [5]

(iii) Hence or otherwise, find $\int \frac{5x^2-3}{2x^3+9x^2+13x+6}\,dx$. [2]

(iv) Show that $\int_0^1 \frac{5x^2-3}{2x^3+9x^2+13x+}\,dx$ = $k$ln5 + $m$ln3 +$p$ln2, where k, m, p are real numbers. [3]

12. The figure below is made up of a right angled triangle and a rectangle of dimension 10 m by 20 m. Given that h is the height of the figure as shown in the diagram.



(i) Show that $h = 10\cos\theta + 20\sin\theta$ m. [2]

(ii) Express h in the form of $R\cos(\theta - \alpha)$ where $R > 0$ and $0^o < \alpha < 90^o$. [3]

(iii) Find the value of θ when h is 21 m. [2]

(iv) Can the height of the figure be taller than 25 m? Explain your answer with clear working steps. [1]

- **The End -**