華僑中學

Hwa Chong Institution
Secondary 3 Examination (Practice C)

CANDIDATE NAME							
CLASS					REGISTER NUMBER		

Mathematics **2 hours**

Additional materials:

Writing papers

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work that you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.

Answer **all** 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.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

The total of the marks for this paper is 80.

This document consists of **8** printed pages.

Mathematical Formulae

Compound interest

$$\text{Total amount} = P\left(1+\frac{r}{100}\right)^n$$

Mensuration

Curved surface area of a cone = πrl

Surface area of a sphere = $4\pi r^2$

Volume of a cone = $\frac{1}{3}\pi r^2 h$

Volume of a sphere = $\frac{4}{3}\pi r^3$

Area of triangle $ABC = \frac{1}{2}ab\sin C$

Arc Length = $r\theta$, where θ is in radians

Sector area = $\frac{1}{2}r^2\theta$, where θ is in radians

Trigonometry

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

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

$$\text{Mean} = \frac{\Sigma fx}{\Sigma f}$$

$$\text{Standard deviation} = \sqrt{\frac{\Sigma fx^2}{\Sigma f} - \left(\frac{\Sigma fx}{\Sigma f}\right)^2}$$

1 Given that $10a\sqrt{by^2+1} = 3y$ where a, b are constants and $a < 0$,

(i) state the sign of y, [1]

(ii) express y in terms of a and b. [3]

2 **(a)** Solve $3(x-8)(x+4) = 7(x-8)$ [2]

(b) Solve the equation $9^{2x+1} = \dfrac{27}{81^{4x-3}}$ [3]

3 Find the range of values of x where $-\dfrac{2}{3}x+2 < 7x+5 \le -2x+11$. Represent on the number line the solution set. [4]

4 **(a)** Simplify $\dfrac{u^3-2u^2+u}{u^3-1}$. [3]

(b) Factorise $4x^2-2x-4x\sqrt{y}+y+\sqrt{y}$ completely. [3]

5 The line $2x-y=6$ meets the curve $x^2+y^2=8$ at two points A and B. Find the coordinates of A and of B. [4]

6 The equation of a circle is $x^2+y^2-12x+16y-525=0$. It has centre C and radius r.

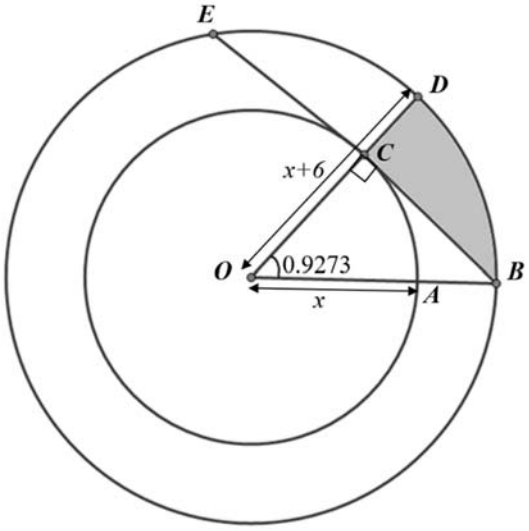
(i) Find the coordinates of C and the value of r. [3]

It is given that the point $Q\ (21,-28)$ lies on the circle.

(ii) Show that CQ passes through the origin O. [2]

(iii) Find the equation of the circle for which OQ is a diameter. Express your answer as $x^2+y^2+kx+qy=0$, where k and q are constants to be found. [3]

7 The diagram shows two concentric circles with centre at O and radii OA and OD as x cm and $(x + 6)$ cm respectively. It is given the line BE is a tangent to the smaller circle at C and $\angle BOD = 0.9273$ radian.



(i) Show that $x = 9.00$. [2]

(ii) Hence, calculate the area of the shaded region BCD. [3]

8 Peter is a diving instructor. He offers lessons for basic and advanced students on weekdays and on weekends. Each student has lesson once a week, for a duration of 16 weeks. The matrix **A** shows the number of students he trains each week in one 16-week block.

$$\begin{matrix} & \text{Basic} & \text{Advance} & \\ \mathbf{A} = & \begin{pmatrix} 7 & 6 \\ 4 & 3 \end{pmatrix} & & \begin{matrix} \text{Weekday} \\ \text{Weekend} \end{matrix} \end{matrix}$$

(i) Evaluate the matrix $\mathbf{B} = 16\mathbf{A}$. [1]

Peter charges \$45 for one basic lesson and \$65 for one advance lesson.

(ii) State the 2×1 column matrix **C** representing the session charges. [1]

(iii) Evaluate the matrix $\mathbf{D} = \mathbf{BC}$. [2]

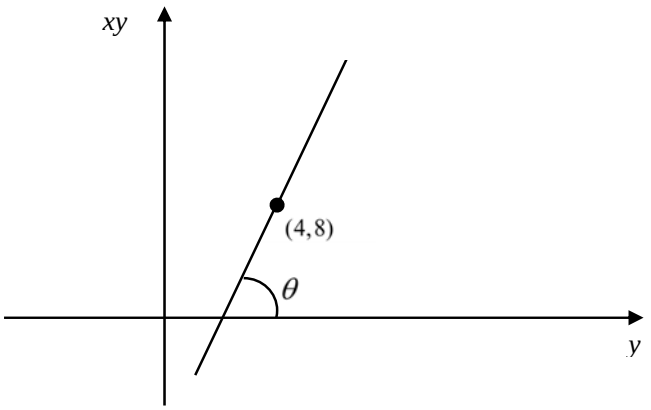
(iv) Explain what elements in **D** represent. [1]

Peter wants to attract more students, so in the next 16-week block he reduces his charges by 20% on both his basic and advance sessions. As a result, he has 10 beginner students and 8 advanced students on weekdays, and 7 beginner students and 4 advanced students on weekends.

(v) Represent the discounted charges for the basic session and advance session in a 2×1 column matrix. [1]

(vi) Hence, find the 1×1 matrix **T** which represents the amount Peter earned in the next 16-week block. [2]

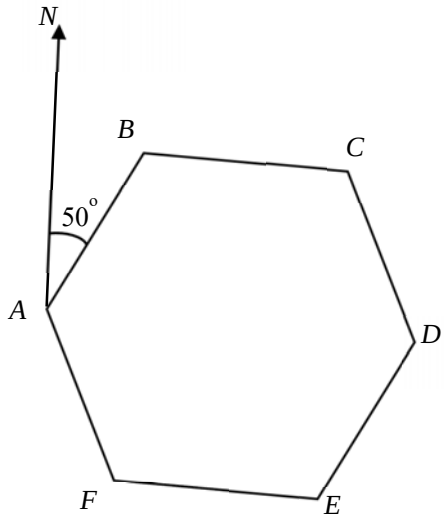
9 The diagram shows part of a straight line drawn to represent the equation $y = \frac{a}{x+b}$ where a and b are constants. It is given that the line passes through $(4,8)$ and has a gradient of 2.5.



(i) Find the value of a and of b. [4]

(ii) Find the value of θ which is the acute angle in radian made by the straight line and the horizontal positive axis, [2]

10 In the below diagram, $ABCDEF$ is a playground in the shape of a regular hexagon. The length of each side of the playground is 5 m. The bearing of B from A is 50°.



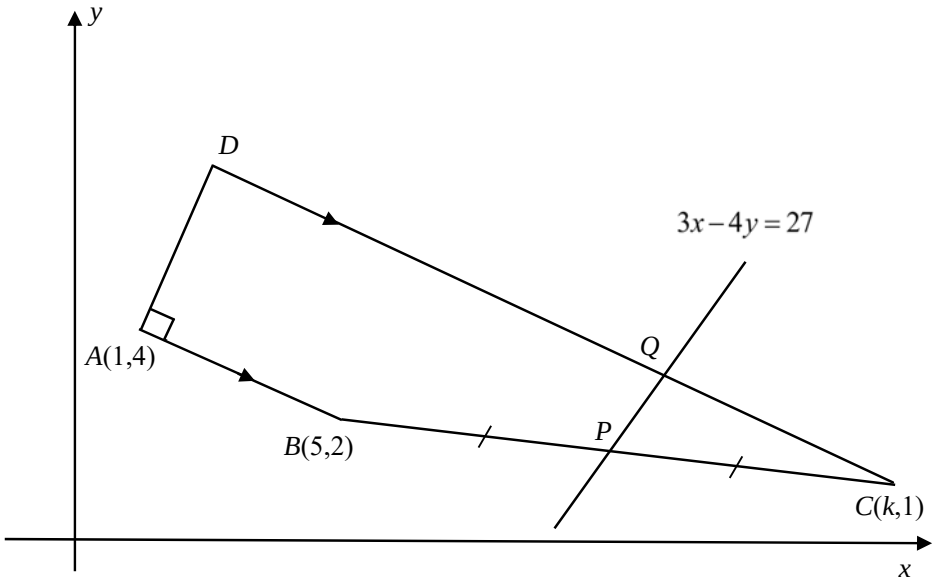
(i) Show that $\angle AFE = 120°$ [1]

(ii) Find the bearing of D from F. [2]

(iii) There is a lamp post of height 2 m at A.
Find the the angle of elevation from E to the top of the lamp post. [3]

[Turn Over

11 The diagram shows a trapezium $ABCD$ in which AB is parallel with DC and $\angle BAD = 90°$. The vertices of the trapezium are at the points $A(1,4)$, $B(5,2)$, $C(k,1)$ and D. The line $3x - 4y = 27$ passes through P, the midpoint of BC and through Q, which lies on CD.



(i) Show that $k = 17$. [3]

(ii) Find the equation of line DC. [3]

(iii) Hence, find the coordinate of Q. [2]

(iv) Find the area of the quadrilateral $ABPQ$. [3]

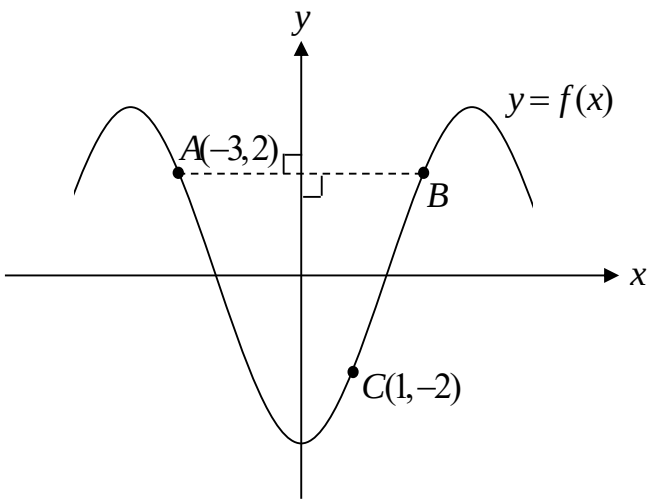
12 **(a)** Given that $f(x) = 1 - 2x + 3x^2 - x^3$ and $h(x) = 7 - 4x + 6x^2 - 2x^3$ is obtained from $f(x)$ through two successive transformation, describe the transformation. [2]

(b) The variables x and y are related in such a way that when $y + x$ is plotted against x^2, a straight line is produced which passes through the points (1, 1) and (13, 4).

(i) Express y in terms of x. [3]

(ii) Sketch the graph of y against x, indicating on your graph the coordinates of the point/s where the curve cuts the axes. [3]

13 The diagram below shows partially the graph of a function f which is symmetrical about the y-axis. The points A, B and C lie on the graph.

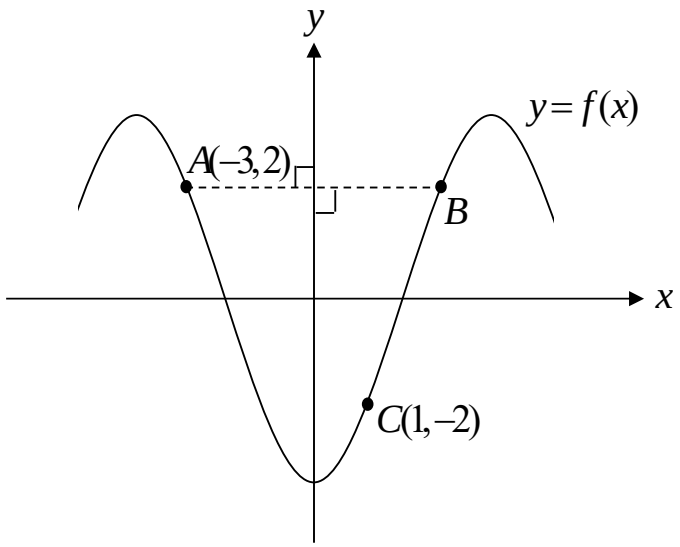


(a) Write down the new coordinates of C under the transformation $y = 2f(x)$. [1]

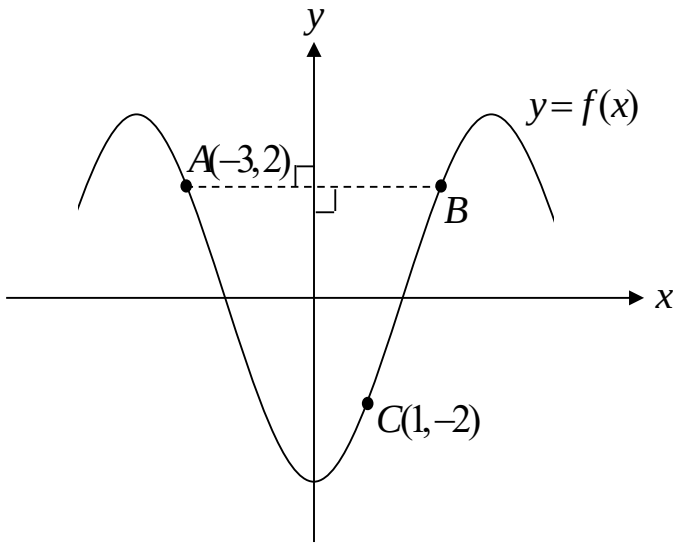
Detach this page and staple to your answer script.

(b) On the same diagram, sketch the graphs of

(i) $y_1 = f(x-2)$, and label clearly the new coordinates of B for each case. [2]



(ii) $y_2 = 1 - f(x)$, and label clearly the new coordinates of B for each case. [2]



End of Paper