

SULIT

**3472/1
Additional
Mathematics
Set 3
2010
2 hours**

Name: _____

Class: _____



JABATAN PELAJARAN NEGERI PERAK

GERAK GEMPUR

SIJIL PELAJARAN MALAYSIA 2010

Additional Mathematics

SET 3 (Paper 1)

Two Hours

Question	Full Marks	Marks Obtained	Question	Full Marks	Marks Obtained
1	2	2	14	2	
2	3	3	15	2	
3	3	3	16	3	
4	3	3	17	4	
5	3	3	18	4	
6	3	3	19	4	
7	3	3	20	3	
8	4	3	21	4	
9	2	4	22	4	
10	3	2	23	3	
11	4	4	24	3	
12	3	4	25	4	
13	3	4	Total Marks	80	

This questions paper consists of 8 printed pages.

INFORMATION FOR CANDIDATES

1. *This question paper consists of **25** questions.*
2. *Answer **all** questions.*
3. *Give only **one** answer for each question.*
4. *Write your answers clearly in the spaces provided in the question paper.*
5. *Show your working. It may help you to get marks.*
6. *If you wish to change your answer, cross out the work that you have done. Then write down the new answer.*
7. *The diagrams in the questions provided are not drawn to scale unless stated.*
8. *The marks allocated for each question are shown in brackets.*
9. *A list of formulae is provided on pages 4 to 6.*
10. *You may use a non-programmable scientific calculator.*
11. *This question paper must be handed in at the end of the examination.*

The following formulae may be useful in answering questions. The symbols given are the ones commonly used.

ALGEBRA

1. $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
2. $a^m \times a^n = a^{m+n}$
3. $a^m \div a^n = a^{m-n}$
4. $(a^m)^n = a^{mn}$
5. $\log_a mn = \log_a m + \log_a n$
6. $\log_a \frac{m}{n} = \log_a m - \log_a n$
7. $\log_a m^n = n \log_a m$
8. $\log_a b = \frac{\log_c b}{\log_c a}$
9. $T_n = a + (n - 1)d$
10. $S_n = \frac{n}{2} [2a + (n - 1)d]$
11. $T_n = ar^{n-1}$
12. $S_n = \frac{a(r^n - 1)}{r - 1} = \frac{a(1 - r^n)}{1 - r}, r \neq 1$
13. $S_\infty = \frac{a}{1 - r}, |r| < 1$

CALCULUS

1. $y = uv, \frac{dy}{dx} = u \frac{dv}{dx} + v \frac{du}{dx}$
2. $y = \frac{u}{v}, \frac{dy}{dx} = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$
3. $\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$
4. Area under a curve

$$= \int_a^b y \, dx \quad \text{or} \quad = \int_a^b x \, dy$$
5. Volume generated

$$= \int_a^b \pi y^2 \, dx \quad \text{or}$$

$$= \int_a^b \pi x^2 \, dy$$

GEOMETRY

1. Distance = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
2. Midpoint $(x, y) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$
3. A point dividing a segment of a line

$$(x, y) = \left(\frac{nx_1 + mx_2}{m + n}, \frac{ny_1 + my_2}{m + n} \right)$$
4. Area of triangle

$$= \frac{1}{2} [(x_1 y_2 + x_2 y_3 + x_3 y_1) - (x_2 y_1 + x_3 y_2 + x_1 y_3)]$$
5. $|r| = \sqrt{x^2 + y^2}$
6. $\hat{r} = \frac{x\hat{i} + y\hat{j}}{\sqrt{x^2 + y^2}}$

STATISTICS

$$1. \quad \bar{x} = \frac{\sum x}{N}$$

$$2. \quad \bar{x} = \frac{\sum fx}{\sum f}$$

$$3. \quad \sigma = \sqrt{\frac{\sum (x - \bar{x})^2}{N}} = \sqrt{\frac{\sum x^2}{N} - \bar{x}^2}$$

$$4. \quad \sigma = \sqrt{\frac{\sum f(x - \bar{x})^2}{\sum f}} = \sqrt{\frac{\sum fx^2}{\sum f} - \bar{x}^2}$$

$$5. \quad m = L + \left(\frac{\frac{1}{2}N - F}{f_m} \right) C$$

$$6. \quad I = \frac{Q_1}{Q_0} \times 100$$

$$7. \quad \bar{I} = \frac{\sum IW}{\sum W}$$

$$8. \quad \bar{I} = \frac{\sum W_i I_i}{\sum W_i}$$

$$9. \quad {}^n P_r = \frac{n!}{(n-r)!}$$

$$10. \quad {}^n C_r = \frac{n!}{(n-r)!r!}$$

$$11. P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$12. P(X = r) = {}^n C_r p^r q^{n-r}, p + q = 1$$

$$13. \quad \text{Mean}, \mu = np$$

$$14. \quad \sigma = \sqrt{npq}$$

$$15. \quad Z = \frac{X - \mu}{\sigma}$$

TRIGONOMETRY

$$1. \quad \text{Arc length, } s = r\theta$$

$$2. \quad \text{Area of sector, } A = \frac{1}{2}r^2\theta$$

$$3. \quad \sin^2 A + \cos^2 A = 1$$

$$4. \quad \sec^2 A = 1 + \tan^2 A$$

$$5. \quad \operatorname{cosec}^2 A = 1 + \cot^2 A$$

$$6. \quad \sin 2A = 2 \sin A \cos A$$

$$\begin{aligned} 7. \quad \cos 2A &= \cos^2 A - \sin^2 A \\ &= 2 \cos^2 A - 1 \\ &= 1 - 2 \sin^2 A \end{aligned}$$

$$8. \quad \sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$9. \quad \cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$10. \quad \tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$$

$$11. \quad \tan 2A = \frac{2 \tan A}{1 - \tan^2 A}$$

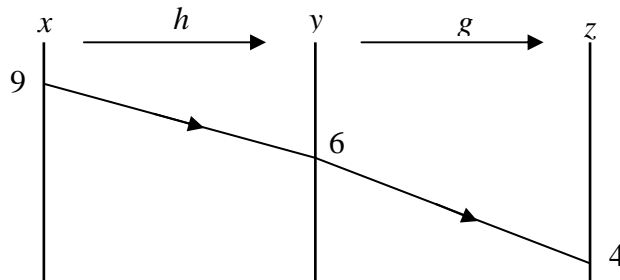
$$12. \quad \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$13. \quad a^2 = b^2 + c^2 - 2bc \cos A$$

$$14. \quad \text{Area of triangle} = \frac{1}{2}ab \sin C$$

Answer **all** questions

- 1 In diagram 1, the function h maps x to y and the function g maps y to z .

**Diagram 1**

Determine

- (a) $h^{-1}(6)$
(b) $gh(9)$

[2 marks]

Answer : (a) _____

(b) _____

- 2 The function v is defined as $v(x) = \frac{6}{x-7}, x \neq 7$.

Find

- (a) $v^{-1}(x)$,
(b) $v^{-1}(3)$.

[3 marks]

Answer : (a) _____

(b) _____

- 3 The following information refers to the functions h and g .

$$h : x \rightarrow 3x + 1$$

$$g : x \rightarrow 6x - 5$$

Find $gh^{-1}(x)$.

[3 marks]

Answer : _____

- 4 The straight line $y = 3x + 2$ touches the curve $y = 2x^2 - x + q$.
Find the value of q .

[3 marks]

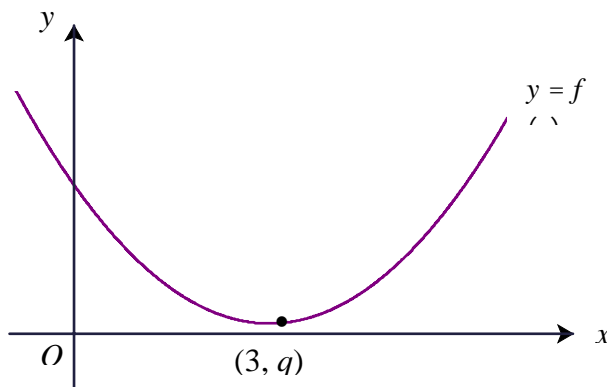
Answer : _____

- 5 Solve the quadratic equation $2x(x - 3) = 3x + 1$.
Give your answer correct to three decimal places.

[3 marks]

Answer : _____

- 6 Diagram 2 shows the graph of a quadratic function $f(x) = 3(p - x)^2 + 2$, where k is a constant.



The curve $y = f(x)$ has the minimum point $(3, q)$, where q is a constant. State

- (a) the value of p ,
(b) the value of q ,
(c) the equation of the axis of symmetry.

[3 marks]

Answer : (a) $p =$ _____

(b) $q =$ _____

(c) _____

- 7 Solve the equation $3^{x-2} + 3^x = 90$.

[3 marks]

Answer : $x =$ _____

- 8 Solve the equation $\log_5 (2x + 3) - \log_5 4x = 1$.

[3 marks]

Answer : $x =$ _____

- 9 Given that $\log_n 3 = k$, $\log_n 5 = h$, express $\log_n \frac{9}{125n^2}$ in terms of k and h .

[4 marks]

Answer : _____

- 10 The first three terms of a sequence are 3, x , 27.
Find the positive value of x so that the sequence is
(a) an arithmetic progression,
(b) a geometric progression.

[2 marks]

Answer : (a) $x =$ _____

(b) $x =$ _____

- 11 The first three terms of a geometric progression are 4, 6, 9.
Find
(a) the common ratio of the progression.
(b) the sum of the 3rd term to the 10th term, give your answer correct to 3 decimal places.

[4 marks]

Answer : (a) _____

(b) _____

- 12 The sum of the first n terms of the arithmetic progression 8, 20, 32, ... is 888.

Find

- (a) the common difference of the progression,
(b) the value of n .

[4 marks]

Answer : (a) _____

(b) $n =$ _____

-
- 13 The variables x and y are related by the equation $y = kx^4$, where k is a constant.

(a) Convert the equation $y = kx^4$ to linear form.

(b) Diagram 3 shows the straight line obtained by plotting $\log_{10} y$ against $\log_{10} x$.

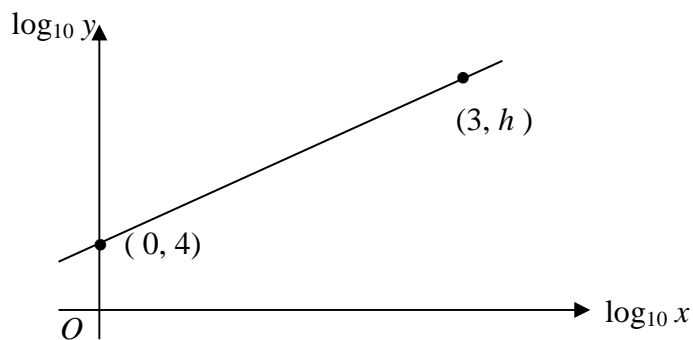


Diagram 3

Find the value of

- (i) $\log_{10} k$,
(ii) h .

[4 marks]

Answer : (a) _____

(b) (i) $\log_{10} k =$ _____

(ii) $h =$ _____

- 14 The following information refers to the equations of two straight lines, ST and UV , which are perpendicular to each other.

$$ST : y = (k - 5)x + 3h$$

$$UV : y = -\frac{h}{10}x - (k - 7)$$

Express h in terms of k .

[2 marks]

Answer : $h =$ _____

- 15 Diagram 4 shows vector \overrightarrow{OA} drawn on a Cartesian plane.

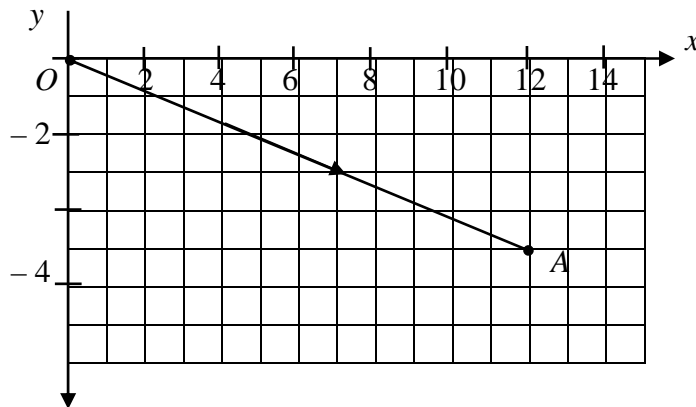


Diagram 4

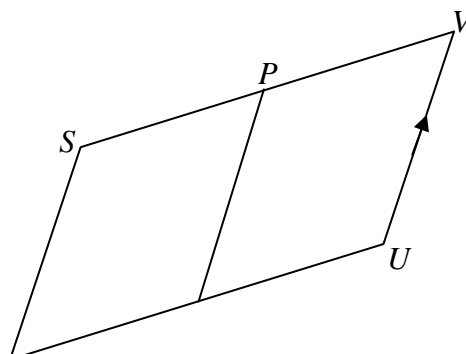
- (a) Express \overrightarrow{OA} in the form $\begin{pmatrix} x \\ y \end{pmatrix}$.
- (b) Find the unit vector in the direction of \overrightarrow{OA} .

[2 marks]

Answer : (a) $\overrightarrow{OA} =$ _____

(b) _____

- 16 Diagram 5 shows a parallelogram, $STUV$. P and Q are the midpoints of SV and TU respectively.





It is given that $\overrightarrow{TU} = 7\mathbf{i} + 3\mathbf{j}$ and $\overrightarrow{UV} = \mathbf{i} + 5\mathbf{j}$.

Find \overrightarrow{TP} .

[3 marks]

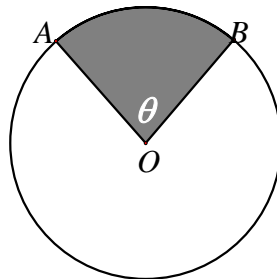
Answer : $\overrightarrow{TP} =$ _____

17 Solve the equation $2 \sin^2 x + 3 \cos x = 3$ for $0^\circ \leq x \leq 360^\circ$

[4 marks]

Answer : $x =$ _____

18 Diagram 6 shows a circle with centre O .



The radius of the circle is 6 cm, and the area of the minor sector OAB is 28 cm^2 .

Using $\pi = 3.142$, find

(a) the value of θ , in radians.

(Give your answer correct to 4 significant figures.)

(b) hence, the length of the major arc OAB , in cm.

[4 marks]

Answer : (a) $\theta =$ _____

(b) _____ cm

-
- 19 Given that $g(x) = \frac{2}{(2x-1)^3}$, evaluate $g''(1)$.

[4 marks]

Answer : _____

-
- 20 The curve $y = -3x^2 - 12x + 7$ has a minimum point at $x = k$, where k is a constant. Find the value of k .

[3 marks]

Answer : $k =$ _____

- 21 Given that $\int_1^6 f(x)dx = 20$ and $\int_1^6 (5f(x) - gx)dx = 30$, find the value of g .

[4 marks]

Answer : _____

-
- 22 A panel of 4 judges is to be selected from 2 male teachers, 4 female teachers and 3 prefects.

Calculate the number of ways the panel can be formed if

- (a) there is no restriction,
(b) the panel comprises of at least 2 teachers.

[4 marks]

Answer : (a) _____

(b) _____

- 23 The mean of a set of data 20, 19, 16, $3k$, k and 1, arranged in descending order is m . If each data in the set is reduced by 3, the median of the new set of data is $\frac{10+m}{2}$.

Find the values of k and of m .

[3 marks]

Answer : $k =$ _____

$m =$ _____

- 24 Table 1 shows cards with letters written on them. The cards are placed in a box.

R	B	R	G
G	R	B	R
G	R	R	B
B	G	R	G

Two cards are drawn at random from the box.

Find the probability that two cards of the same letter are chosen.

[3 marks]

Answer : _____

- 25 A standard test is conducted by a college as an entrance requirement. In 2008, the mean score for the test was 476, with a standard deviation of 107.

Assuming that the scores are normally distributed, find

- (a) the score of the students which gives a standard score of 0.6,
(b) the percentage of students with score higher than 400.

[4 marks]

Answer : (a) _____

(b) _____

END OF QUESTION PAPER

SULIT

**3472/2
Additional
Mathematics
Set 3
2010
2 ½ hours**

Name: _____

Class: _____



JABATAN PELAJARAN NEGERI PERAK

**GERAK GEMPUR
SIJIL PELAJARAN MALAYSIA 2010
Additional Mathematics
SET 3 (Paper 2)
Two Hours Thirty Minutes**

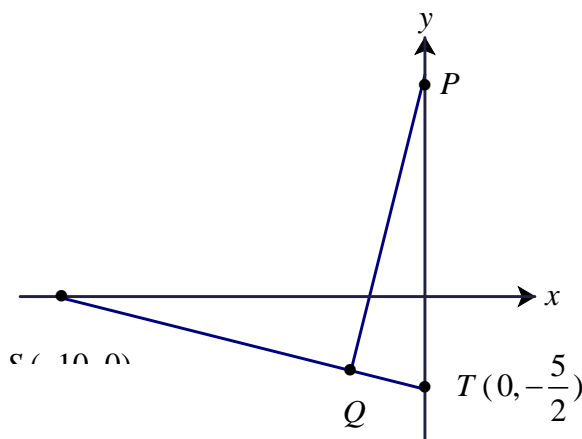
Section	Question	Full Marks	Marks Obtained
A	1	5	
	2	6	
	3	6	
	4	7	
	5	8	
	6	6	
B	7	10	
	8	10	
	9	10	
	10	10	
C	11	10	
	12	10	
	13	10	
	14	10	
Total		100	

Section A

[40 marks]

Answer **all** questions in this section.

- 1 Solve the simultaneous equations $11x - 2y = 12$ and $x^2 + 2x - y = 3$. [5 marks]
- 2 Diagram 1 shows a straight line PQ which meets a straight line ST at the point Q . The point P lies on the y -axis.

**Diagram 1**

- (a) Write down the equation of ST in the form of intercepts. [1 mark]
 - (b) Given $QT = \frac{1}{5}ST$, find the coordinates of Q . [2 marks]
 - (c) Given that PQ is perpendicular to ST , find the y -intercept of PQ . [3 marks]
- 3
 - (a) Sketch the graph of $y = 2 \sin 2x$ for $0^\circ \leq x \leq 180^\circ$. [3 marks]
 - (b) Hence, by drawing a suitable straight line on the same axes, find the number of solutions satisfying the equation $4 \cos^2 x = \frac{2-x}{\tan x}$. [3 marks]
- 4 The sum of 16 numbers is 160. The sum of the squares of these numbers is 1990.
 - (a) Find the mean and variance of the 16 numbers. [3 marks]
 - (b) A number is removed from the set and the mean is decreased by 1. Find
 - (i) the value of this number,
 - (ii) the standard deviation of the set of 15 numbers, give your answer correct to 3 decimal places. [4 marks]

- 5 The gradient function of a curve which passes through $P(2, -7)$ is $6x(x - 1)$.
Find
(a) the equation of the curve, [3 marks]
(b) the coordinates of the turning points of the curve and determine whether each of the turning points is a maximum or a minimum. [5 marks]
- 6 Diagram 2 shows four rectangles. The largest rectangle has a length of k cm and a width of h cm. The measurement of the length and width of each subsequent rectangle are half of the measurements of its previous one. The areas of the rectangles form a geometric progression. The terms of the progression are in descending order.

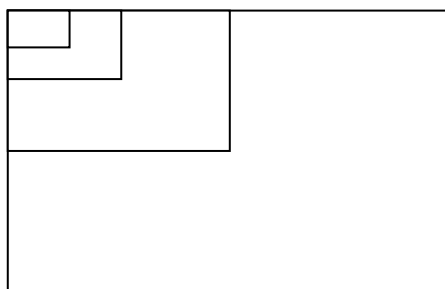


Diagram 2

- (a) State the common ratio, hence find the area of the first rectangle given the sum of the four rectangles is 510 cm^2 . [4 marks]
(b) Determine which rectangle has an area of 96 cm^2 . [2 marks]
(c) Find the sum to infinity of the areas, in cm^2 , of the rectangles. [2 marks]

Section B

[40 marks]

Answer **four** questions from this section.

- 7 Use graph paper to answer this question.

Table 1 shows the values of two variables, x and y , obtained from an experiment. Variables x and y are related by the equation $y = pk^x$, where p and k are constants.

x	1	2	3	4	5	6
y	4.68	7.12	11.04	16.53	25.56	40.01

- (a) Plot $\log_{10} y$ against x by using a scale of 2 cm to 1 unit on the x -axis and 2 cm to 0.2 unit on the $\log_{10} y$ -axis.
Hence, draw the line of best fit. [4 marks]
(b) Use your graph from (a) to find the value of
(i) p ,
(ii) k . [6 marks]

- 8 In Diagram 3, ASC and BSD are straight lines.

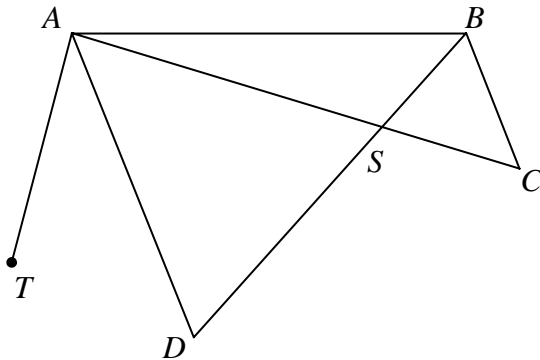


Diagram 3

Given that $\overrightarrow{AB} = \underline{x}$, $\overrightarrow{BC} = \underline{y}$ and $\overrightarrow{AD} = 2\overrightarrow{BC}$.

- (a) Express in terms of \underline{x} and/or \underline{y} ,

- (i) \overrightarrow{AC}
(ii) \overrightarrow{BD}

[2 marks]

- (b) Given that $\overrightarrow{AS} = m\overrightarrow{AC}$ and $\overrightarrow{BS} = n\overrightarrow{BD}$.

Express \overrightarrow{AS}

- (i) in terms of m , \underline{x} and \underline{y} .
(ii) in terms of n , \underline{x} and \underline{y} .

Hence, show that $m + n = 1$ and state the values of m and of n .

[6 marks]

- (c) If $\overrightarrow{TA} = \frac{1}{3}(\underline{x} - 5\underline{y})$, prove that AC and TD are parallel.

[2 marks]

- 9 Diagram 4 shows a circle $EDGH$, centre O and radius 5 cm. EB , DB and AC are tangents to the circle at E , D and G respectively. The straight lines, OA and OC intersect the circle at E and D respectively. ABC is an arc of a circle, centre O .

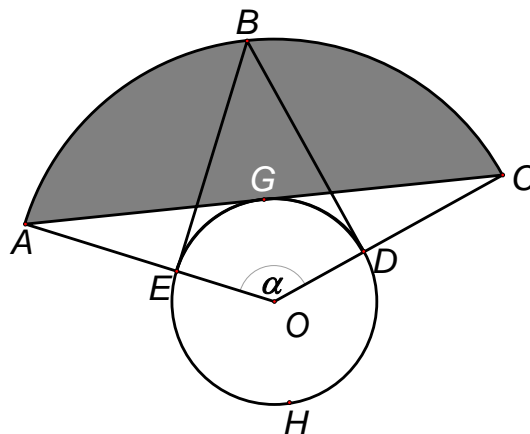


Diagram 4

Given $BD = 12$ cm, calculate

- (a) the angle α , in radians. [3 marks]
- (b) the length, in cm, of the arc ABC . [3 marks]
- (c) the area, in cm^2 , of the shaded region. [4 marks]

- 10 Diagram 5 shows part of the curve $y = \frac{3}{(x-2)^2}$. The straight line $y = x$ intersects the curve at A.

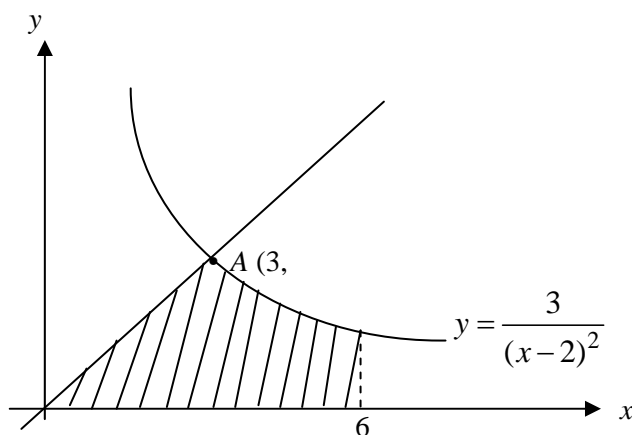


Diagram 5

- (a) Find the equation of the tangent to the curve at the point A. [3 marks]
- (b) Find the area of the region.
- (c) A region is bound by the curve, the x -axis and two straight lines $x = 3$ and $x = 6$. Find the volume generated, in terms of π . [6 marks]
- 11 (a) A club organizes a practice session for students on archery sport. Each student takes 10 shots. The probability that a student makes a successfully shot is p . After the session, it was calculated that the mean number of successful shots for a student is 3.2.
- Find the value of p .
 - If a student is chosen at random, find the probability that the student makes at least 2 successful shots. [5 marks]
- (b) The mass of chickens reared by a farmer are found normally distributed with mean 3.1 kg and variance 0.082 kg^2 .
- Find the probability that a chicken chosen randomly has mass less than 2.8 kg.
 - Given that 70% of the chickens have a mass of more than m kg, find the value of m . [5 marks]

Section C

[20 marks]

Answer **two** questions from this section

- 12 Table 2 shows the price indices and percentage of usage of four items, P , Q , R and S , which are the main ingredients in the production of a type of cake.

Item	Price index for the year 2007 based on the year 2005	Percentage of the usage (%)
P	145	20
Q	120	30
R	115	40
S	x	10

(a) Calculate

- (i) the price of P in the year 2005 if the price in the year 2007 is RM26.10,
 (ii) the price index of Q in the year 2007 based on the year 2003 if its price index in the year 2005 based on the year 2003 is 125. [5 marks]

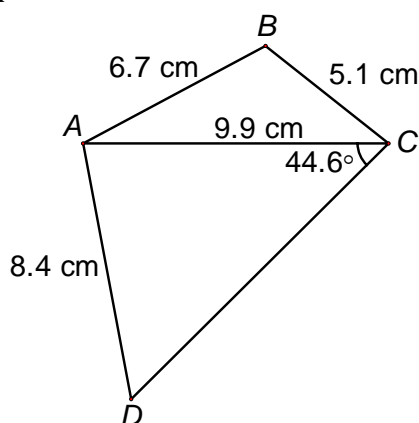
(b) The composite index number of the cost of cake production for the year 2007 based on the year 2005 is 110.

Calculate

- (i) the value of x ,
 (ii) the price of a cake in the year 2005 if the corresponding price in the year 2007 is RM 72.

[5 marks]

- 13 Diagram 6 shows a quadrilateral $ABCD$ such that $\angle ADC$ is acute.

**Diagram 6**

(a) Calculate

- (i) $\angle ADC$,
 (ii) $\angle ABC$,
 (iii) the area, in cm^2 , of quadrilateral $ABCD$ [8 marks]
- (b) A triangle $A'C'D'$ has the same measurements as those given for triangle ACD , that is, $A'C' = 9.9$ cm, $A'D' = 8.4$ cm and $\angle A'C'D' = 44.6^\circ$, but which is different in shape to triangle ACD .
 (i) Sketch the triangle $A'C'D'$.
 (ii) State the size of $\angle A'D'C'$. [2 marks]
- 14 A particle moves in a straight line from a fixed point O . Its velocity, $v \text{ ms}^{-1}$, is given by $v = 4t(4 - t)$, where t is the time, in seconds, after leaving the point O . Find
- (a) the maximum velocity of the particle, [3 marks]
 (b) the displacement of the particle at $t = 5$ s, [3 marks]
 (c) the time when the particle passes the fixed point O again, [2 marks]
 (d) the range of values of t between leaving O and when the particle reverses its direction of motion. [2 marks]
- 15 Use the graph paper provided to answer this question.
- A company provides transportation to the most 480 workers using x buses and y vans. Each bus carries 40 workers while a van carries 12 workers. The cost of transportation using a bus is RM200 while that of a van is RM100. The total cost of transportation for a day must not exceed RM3000. More buses than van should be used for the transportation.
- (a) Write down three inequalities, other than $x \geq 0$ and $y \geq 0$, which satisfy all the above constraints. [3 marks]
 (b) By using a scale of 2 cm to 2 units on the x -axis and 2 cm to 5 units on the y -axis, construct and shade the region R that satisfies all the above constraints. [3 marks]
 (c) Using your graph from (b), find
 (i) the maximum number of buses used if 3 vans are used,
 (ii) the number of workers transported as in (i),
 (iii) the cost of transportation as in (i). [4 marks]

END OF QUESTION PAPER

INFORMATION FOR CANDIDATES
MAKLUMAT UNTUK CALON

1. This question paper consists of three sections: **Section A**, **Section B** and **Section C**.
*Kertas soalan ini mengandungi tiga bahagian: **Bahagian A**, **Bahagian B** dan **Bahagian C**.*
2. Answer **all** questions in **Section A**, any **four** questions from **Section B** and any **two** questions from **Section C**.
*Jawab **semua** soalan dalam **Bahagian A**, mana-mana **empat** soalan daripada **Bahagian B** dan mana-mana **dua** soalan daripada **Bahagian C**.*
3. Write your answers on the 'buku jawapan' provided. If the 'buku jawapan' is insufficient, you may ask for 'helaian tambahan' from the invigilator.
Jawapan anda hendaklah ditulis di dalam buku jawapan yang disediakan. Sekiranya buku jawapan tidak mencukupi, sila dapatkan helaian tambahan daripada pengawas peperiksaan.
4. Show your working. It may help you to get marks.
Tunjukkan langkah-langkah penting dalam kerja mengira anda. Ini boleh membantu anda untuk mendapatkan markah.
5. The diagrams in the questions provided are not drawn to scale unless stated.
Rajah yang mengiringi soalan tidak dilukis mengikut skala kecuali dinyatakan.
6. The marks allocated for each question and sub-part of a question are shown in brackets.
Markah yang diperuntukkan bagi setiap soalan dan ceraian soalan ditunjukkan dalam kurungan.
7. A list of formulae is provided on pages 3 to 5.
Satu senarai rumus disediakan di halaman 3 hingga 5.
8. Graph paper and a booklet of four-figure mathematical tables is provided.
Kertas graf dan sebuah buku sifir matematik empat angka disediakan.
9. You may use a non-programmable scientific calculator.
Anda dibenarkan menggunakan kalkulator saintifik yang tidak boleh diprogram.
10. Tie the 'helaian tambahan' and the graph papers together with the 'buku jawapan' and hand in to the invigilator at the end of the examination.
Ikat helaian tambahan dan kertas graf bersama-sama dengan buku jawapan dan serahkan kepada pengawas peperiksaan pada akhir peperiksaan.



GERAK GEMPUR SPM 2010
ANJURAN JABATAN PELAJARAN PERAK

ADDITIONAL MATHEMATICS

PAPER 1 (SET 3)

Time: Two hours

MARK SCHEME

Q	Answer	Marks
1	(a) $h^{-1}(6) = 9$	1
	(b) $gh(9) = g(6) = 4$	1
2	(a) $v^{-1}(x) = \frac{6+7x}{x}$ $x = \frac{6+7y}{y}$ seen, allocate 1 mark.	2
	(b) $v^{-1}(3) = 9$	1
3	$gh^{-1} = 2x - 7$ $g\left[\frac{x-1}{3}\right] = 6\left[\frac{x-1}{3}\right] - 5$ seen, allocate 2 marks. $x = \frac{y-1}{3}$ seen, allocate 1 mark.	3
4	$q = 4$ $(-4)^2 - (4)(2)(q-2) = 0$ seen, allocate 2 marks $2x^2 - 4x + q - 2 = 0$ seen, 1 mark	3
5	$x = 4.608$ and -0.108 $x = \frac{-(-9) \pm \sqrt{(-9)^2 - (4)(2)(-1)}}{2(2)}$ seen, allocate 2 marks $2x^2 - 9x - 1 = 0$ seen, 1 mark.	3

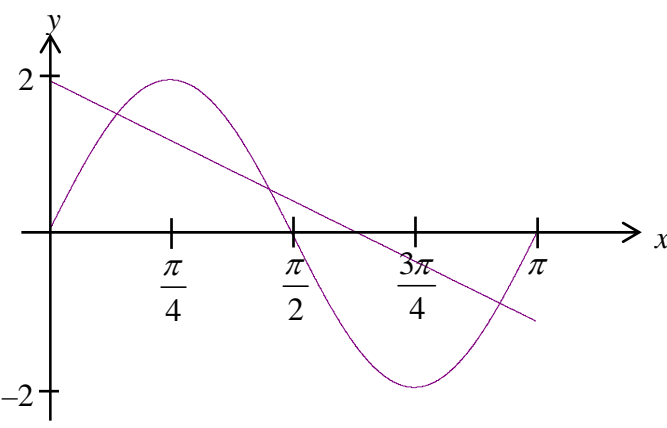
Q	Answer	Marks
6	$p = 3$ $q = 2$ $x = 3$	1 1 1
7	$x = 4$ $10 (3^x) = 810$ seen, allocate 2 marks. $\frac{3^x}{3^2}$ seen, 1 mark.	3
8	$x = \frac{1}{6}$ $\frac{2x+3}{4x} = 5$ or equivalent seen, allocate 2 marks. $\log_5 \frac{2x+3}{4x}$ seen, allocate 1 mark.	3
9	$2k - 3h - 2$ $2 \log_n 3 - 3 \log_n 5 - 2 \log_n n$ $\log_n 9 - \log_n 125 - \log_n n^2$ or equivalent $\log_n 9 - \log_n 125n^2$	4 3 2 1
10	$x = 15$ $x = 9$	1 1
11	(a) $r = \frac{3}{2}$ (b) 425.320 $\frac{4 \left[\left(\frac{3}{2} \right)^{10} - 1 \right]}{\frac{3}{2} - 1} - \frac{4 \left[\left(\frac{3}{2} \right)^2 - 1 \right]}{\frac{3}{2} - 1}$ seen, allocate 2 marks. $\frac{4 \left[\left(\frac{3}{2} \right)^{10} - 1 \right]}{\frac{3}{2} - 1} \quad \text{or} \quad \frac{4 \left[\left(\frac{3}{2} \right)^2 - 1 \right]}{\frac{3}{2} - 1}$ allocate 1 mark.	1 3

Q	Answer	Marks
12	(a) 12 (b) $n = 12$ $12n^2 + 4n - 1776 = 0$ or equivalent, 2 marks $\frac{n}{2}(2(8) + (n-1)12) = 888$ seen, 1 mark	1 3
13	(a) $\log_{10} y = 4 \log_{10} x + \log_{10} k$ $\log_{10} y = \log_{10} kx^4$ seen, allocate 1 mark. (b) (i) $\log_{10} k = 4$ (ii) $h = 16$	2 1 1
14	$h = \frac{10}{k-5}$ $(k-5)(-\frac{h}{10}) = -1$ seen, allocate 1 mark	2
15	(a) $\begin{pmatrix} 12 \\ -5 \end{pmatrix}$ (b) $\frac{1}{13}(12\hat{i} - 5\hat{j})$	1 1
16	$\frac{1}{2}(9\hat{i} + 13\hat{j})$ $\frac{1}{2}(7\hat{i} + 3\hat{j}) + \hat{i} + 5\hat{j}$ seen, allocate 2 marks. $\frac{1}{2} \vec{TU} + \vec{OQ}$ seen, 1 mark.	3
17	$x = 0^\circ, 60^\circ, 300^\circ, 360^\circ$ $\cos x = \frac{1}{2}$ and $\cos x = 1$ seen, allocate 3 marks. $2 \cos^2 x - 3 \cos x + 1 = 0$ seen, allocate 2 marks. $1 - \cos^2 x$ seen, 1 mark.	4
18	(a) $\theta = 1.556$ $\frac{1}{2} \times 6^2 \times \theta = 28$ seen, allocate 1 mark. (b) 28.37 cm 4.728 (size of major angle OAB) seen, allocate 1 mark.	2 2

Q	Answer	Marks
19	$\frac{96}{(2x-1)^5}$ or equivalent, allocate 3 marks. $-12(-4)(2x-1)^{-5} \cdot 2$ or equivalent, allocate 2 marks. $2(-3)(2x-1)^{-4} \cdot 2$ or equivalent, allocate 1 mark.	4
20	$k = -2$ $-6x - 12 = 0$ seen, allocate 2 marks. $-6x - 12$ seen, allocate 1 mark.	3
21	$g = 4$ $100 - (18g - \frac{g}{2}) = 30$ seen, allocate 3 marks. $5 \int_1^6 f(x) dx - \int_1^6 g x dx = 30$ seen, allocate 2 marks. $\frac{gx^2}{2}$ seen, allocate 1 mark.	4
22	(a) 126 (b) 120 $120 - {}^6C_1 \times {}^3C_3$ or ${}^6C_4 + {}^6C_3 \times {}^3C_1 + {}^6C_2 \times {}^3C_2$ seen, allocate 2 marks.	2 3
23	$k = 4$ and $m = 12$ $\frac{56+4k}{6} = 3k$ or equivalent seen, allocate 2 marks $\frac{56+4k}{6} = m$ or $3k = m$ or equivalent, allocate 1 mark.	3
24	$\frac{37}{120}$ $(\frac{7}{16} \times \frac{6}{15}) + (\frac{5}{16} \times \frac{4}{15}) + (\frac{4}{16} \times \frac{3}{15})$ seen, allocate 2 marks. $(\frac{7}{16} \times \frac{6}{15})$ or $(\frac{5}{16} \times \frac{4}{15})$ or $(\frac{4}{16} \times \frac{3}{15})$ seen, allocate 1 mark.	3
25	(a) $x = 540.2$ (b) 76.11% 0.7611 seen, allocate 2 marks. $P(Z > \frac{400-476}{107})$ seen, 1 mark.	2 3



Time: Two hours thirty minutes

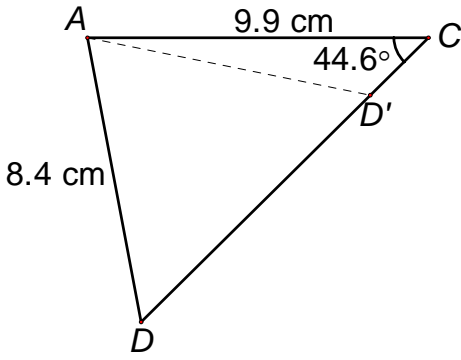
Q	Answer	Marks
3	 <p>Maximum (2) and minimum (-2) marked.</p> <p>Graph drawn from 0 to π.</p> <p>Graph correctly drawn.</p> <p>$2 \sin 2x = 2 - x$</p> <p>Straight line correctly drawn, y-intercept = 2</p> <p>Solutions = 3</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
4	<p>(a) Mean = 10</p> $\text{Variance} = \frac{1990}{16} - 10^2$ $= 24.375$ <p>(b) $9 = \frac{\sum x}{15}$</p> <p>25</p> $\sigma = \sqrt{\frac{1990 - 25^2}{15} - 9^2}$ <p>3.162</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>

Q	Answer	Marks
5	<p>(a) $y = \int (6x^2 - 6x)dx$</p> <p>$(-7) = \frac{6(2)^3}{3} - \frac{6(2)^2}{2} + c$</p> <p>$y = 2x^3 - 3x^2 - 11$</p> <p>(b) $\frac{d^2y}{dx^2} = 12x - 6$</p> <p>$(0, -11)$, maximum</p> <p>$(1, -12)$, minimum</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1 + 1</p> <p>1 + 1</p>
6	<p>(a) $T_1 = kh$</p> <p>$T_2 = \frac{1}{2}k \cdot \frac{1}{2}h = \frac{1}{4}kh$</p> <p>$T_3 = \frac{1}{4}k \cdot \frac{1}{4}h = \frac{1}{16}kh$</p> <p>$r = \frac{1}{4}$</p> <p>$510 = \frac{a(1 - (\frac{1}{4})^4)}{1 - \frac{1}{4}}$</p> <p>$a = 384$</p> <p>(b) $96 = 384(\frac{1}{4})^{n-1}$</p> <p>$n = 2$</p> <p>(c) $S_{\infty} = \frac{384}{1 - \frac{1}{4}}$</p> <p>$S_{\infty} = 512$</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>

Q	Answer							Marks	
7	x	1	2	3	4	5	6		
	y	4.68	7.12	11.04	16.53	25.56	40.01		
	$\log_{10} y$	0.670	0.852	1.043	1.218	1.408	1.602		
	$y = pk^x$								
	$\log_{10} y = \log_{10} pk^x$								1
	$\log_{10} y = (\log_{10} k)x + \log_{10} p$								1
	$\log_{10} p = 0.48$								1
	$p = 3.02$								1
	$\log_{10} k = \frac{0.6}{3.2}$								1
	$k = 1.54$								1
8	(a) (i) $\overrightarrow{AC} = x + y$							1	
	(ii) $\overrightarrow{BD} = -x + 2y$							1	
	(b) (i) $\overrightarrow{AS} = mx + my$							1	
	(ii) $\overrightarrow{AS} = (1 - n)x + 2ny$							1	
	Comparing (i) & (ii), $\left. \begin{array}{l} m = 1 - n \\ \therefore m + n = 1 \end{array} \right\}$							1	
	Solve S.E.: $m + n = 1$ and $2n = m$							1	
	$m = \frac{1}{2}, \quad n = \frac{1}{4}$							1 + 1	
	(c) $\overrightarrow{TD} = \frac{1}{3}(x - 5y) + 2y$							1	
	$= \frac{1}{3}(x + y)$							1	
	$\therefore \overrightarrow{AC} = x + y \quad \therefore \overrightarrow{AC} \parallel \overrightarrow{TD}$ proven.								

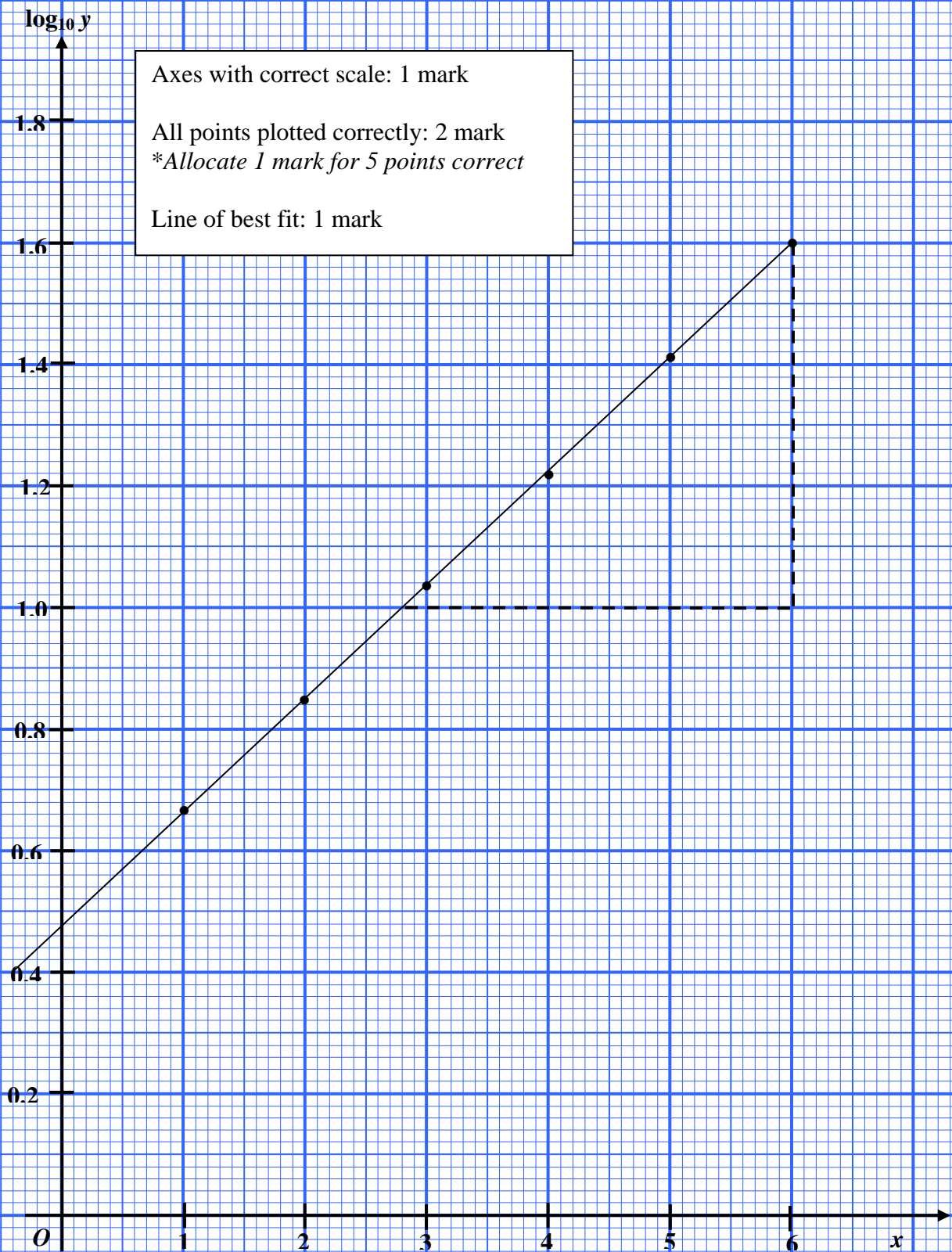
Q	Answer	Marks
9	<p>(a) $\tan \alpha = \frac{12}{5}$</p> <p>$67.38^\circ \times \frac{\pi}{180}$ or $134.76^\circ \times \frac{\pi}{180}$</p> <p>$\alpha = 2.352$ rad.</p> <p>(b) $OB = 13$ cm</p> <p>$\angle ABC = 13(2.352)$ $= 30.576$ cm</p> <p>(c) *① $\frac{1}{2}(13)^2 \cdot (2.352)$</p> <p>*② $\frac{1}{2}(13)(13)\sin 134.76$</p> <p>① – ②</p> <p>138.744 cm²</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
10	<p>(a) $\frac{dy}{dx} = -\frac{6}{(x-2)^3}$</p> <p>when $x = 3$, $\frac{dy}{dx} = -6$</p> <p>$y = -6x + 21$</p> <p>(b) $\frac{1}{2}(3 \times 3)$ unit²</p> <p>$\int_3^6 \frac{3}{(x-2)^2} dx$</p> <p>$3 \left[\frac{(x-2)^{-1}}{-1} \right]_3^6$</p> <p>6.75 unit²</p> <p>(c) $\pi \int_3^6 \left[\frac{3}{(x-2)^2} \right]^2 dx$</p> <p>$9\pi \left[\frac{(x-2)^{-3}}{-3} \right]_3^6$</p> <p>$2\frac{61}{64}\pi$ or 2.953π</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>

Q	Answer	Marks
11	<p>(a) $7.9 = 10p$</p> <p>$p = 0.79$</p> <p>$P(X \geq 6)$</p> <p>$1 - {}^{10}C_5 0.79^5 0.21^5$</p> <p>0.968</p> <p>(b) $(P < 2.8) = P(Z < \frac{2.8 - 3.1}{0.2864})$</p> <p>$= 0.1485$</p> <p>$P(Z > \frac{m - 3.1}{0.2864}) = 0.70$</p> <p>$\frac{m - 3.1}{0.2864} = 0.2420$</p> <p>$m = 3.169 \text{ kg}$</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
12	<p>(a) $145 = \frac{RM 26.10}{P_{2005}} \times 100$</p> <p>$P_{2005} = RM 18.00$</p> <p>$\frac{P_{2007}}{P_{2003}} \times 100 = \frac{P_{2007}}{P_{2005}} \times \frac{P_{2005}}{P_{2003}} \times 100$</p> <p>$= \frac{145}{100} \times \frac{120}{100} \times 100$</p> <p>$= 174$</p> <p>(b) $\frac{0.2 \times 145 + 0.3 \times 120 + 0.4 \times 115 + 0.1 \times x}{0.2 + 0.3 + 0.4 + 0.1}$</p> <p>$\frac{0.2 \times 145 + 0.3 \times 120 + 0.4 \times 115 + 0.1 \times x}{0.2 + 0.3 + 0.4 + 0.1} = 125$</p> <p>$x = 140$</p> <p>$125 = \frac{72}{P_{2005}} \times 100$</p> <p>$P_{2005} = RM 57.60$</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>

Q	Answer	Marks
13	<p>(a) (i) $\frac{9.9}{\sin \angle ADC} = \frac{8.4}{\sin 44.6^\circ}$ $\angle ADC = 55.85^\circ$ or $55^\circ 50'$</p> <p>(ii) $9.9^2 = 6.7^2 + 5.1^2 - 2(6.7)(5.1) \cos \angle ABC$ $\cos \angle ABC = -0.3967$ $\angle ABC = 113.37^\circ$ or $113^\circ 22'$</p> <p>(iii) $\frac{1}{2} \times 6.7 \times 5.1 \times \sin 113.37^\circ$ $\frac{1}{2} \times 9.9 \times 8.4 \times \sin 79.55^\circ$ 56.573 cm^2</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
	<p>(b)(i)</p>  <p>(ii) 124.15° or $124^\circ 9'$</p>	<p>Correct construction of dotted line</p> <p>1</p> <p>1</p>
14	<p>(a) $\frac{dv}{dt} = 16 + 8t$ $16 - 8t = 0$ $v = 16 \text{ ms}^{-1}$</p> <p>(b) $S = \frac{16t^2}{2} - \frac{4t^3}{3}$ $S = 8(25) - \frac{4}{3}(125)$ $= 33.333 \text{ m}$</p> <p>(c) $8t^2 - \frac{4}{3}t^3 = 0$ $t = 6$</p> <p>(d) $4t(4 - t) = 0$ $0 \leq t \leq 4$</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>

Q	Answer	Marks
15	(a) $40x + 12y \leq 480$	1
	$200x + 100y \leq 3000$	1
	$x > y$	1
	(b) Refer to graph paper	3
	(c) (i) 11 buses	1
	(ii) $11(40) + 3(12)$	1
	476	1
	(iii) RM 2500	1

Q 7



Q 15

*At least one straight line drawn correctly: 1 mark
or

*All straight lines drawn correctly: 2 marks

Region R shaded: 1 mark

