

**Section A****[40 marks]**Answer *all* the questions.

1. Diagram 1 shows a rectangle  $OABC$ . It is given that  $\overrightarrow{AC} = 4\mathbf{i} + 9\mathbf{j}$ .

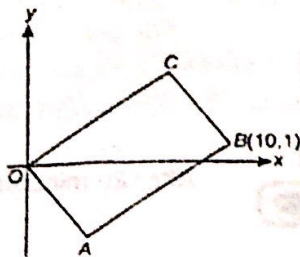


Diagram 1

- (a) Find the coordinate of  $A$ . [3 marks]

- (b)  $D$  is a point such that  $\overrightarrow{CD} = 17\mathbf{i} + 6\mathbf{j}$ . Show that the points  $A$ ,  $B$  and  $D$  are collinear. [4 marks]

2. A meteorologist conducts a study on the warmest and the coolest time in the town  $B$  for a particular day. The trigonometric function used to illustrate the temperature,  $P$ , during different times,  $t$ , as follows :

$$P = 3 \sin 2t$$

- (a) Sketch the graph of  $P = 3 \sin 2t$  for  $0 \leq t \leq \pi$ . [2 marks]

- (b) Hence, using the same axes, sketch a suitable straight line to find the number of solutions to the equation  $\sin t = \frac{5t}{6\pi \cos t}$  for  $0 \leq t \leq \pi$ . [3 marks]

3. Jia Yang bought a certain number of pens for RM 60. If each pen had a discount of 20 cents, he could have bought 10 more pens for the same amount of money. Find the number of pens that Jia Yang bought. [6 marks]

4. (a) Determine whether  $\log_{10}(x+1)$  is equal to, less than or greater than  $\log_{10} x + 1$ , where  $x$  is a positive integer. Explain your answer. [4 marks]

- (b) Solve the following equation :

$$5^{x-1}(2^{x+2}) = 40$$

[3 marks]



5. Bacteria *Y* reproduce by binary fission process as shown in Diagram 2. Under the optimum condition, this process will take 20 minutes.

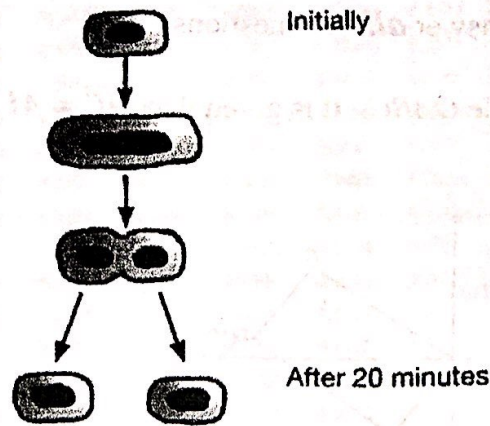
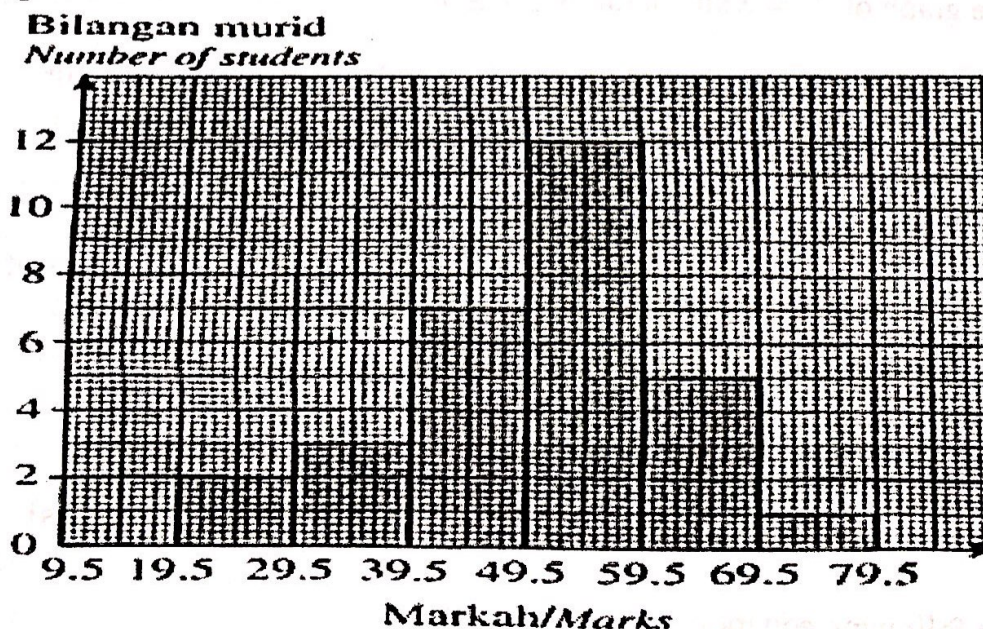


Diagram 2

A study on reproduction is carried out in 10 samples of bacteria *Y*. The first sample contains 2 bacteria *Y*. The number of bacteria in the next sample is 3 times the number of its previous sample.

- What is the total number of bacteria *Y* in the entire sample at the beginning of the study? [3 marks]
- After a certain period, it is found that the number of bacteria in the 6<sup>th</sup> sample is 124416. Determine the period, in minutes. [3 marks]

6. Diagram 3 is a histogram showing the distribution of marks of 30 students for an assignment.



- Based on the histogram, determine the modal mark of the students. [1 mark]
- Without using an ogive, calculate the interquartile range of the marks. [4 marks]
- Calculate the variance of the distribution. [3 marks]



- (d) Later their teacher realises that there is an error in the marking scheme where 2 extra marks are wrongly given to each question. Determine the effect of the error on the mean. [1 mark]

**Section B**  
[40 marks]

Answer any **four** questions from this section.

7. **Solution by scale drawing is not accepted.**

Diagram 4 shows the location of house A, house B and house C drawn on a Cartesian plane. It is given that house M(1, 6) is at the midpoint of house B and house C.

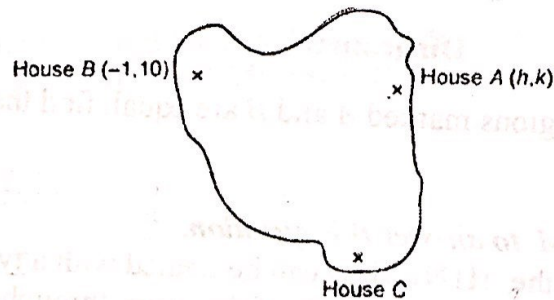


Diagram 4

- (a) Find the location for house C. [2 marks]
- (b) The straight road from location of house A to the location of house M is perpendicular to the straight road from location of house B to the location of house C. The gradient of the straight road from location of house A to house B is  $-\frac{1}{3}$ . Find the value of  $h$  and of  $k$ . [6 marks]
- (c) Calculate the area bounded by house A, house B and house C. [2 marks]
8. The equation of a curve is  $y = \frac{36}{(2x+1)^2}$ .

- (a) A point  $P$  moves along the curve in such a way that the  $x$ -coordinate of  $P$  increases at a constant rate of 0.02 units per second. Find the  $x$ -coordinate of  $P$  at the instant the  $y$ -coordinate is decreasing at a rate of 0.36 units per second. [4 marks]
- (b) Diagram 5 shows part of a curve  $y = \frac{36}{(2x+1)^2}$  passing through the points with coordinates  $(1, 4)$  and  $(4, \frac{4}{9})$ . Also shown are three lines perpendicular to the  $x$ -axis at the points with  $x$ -coordinates are 1,  $a$  and 4.



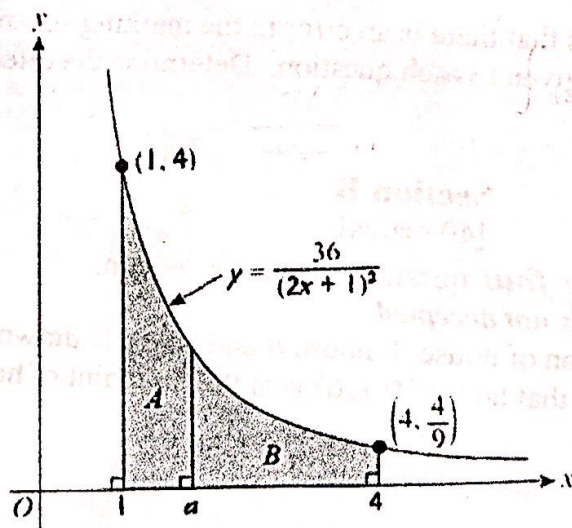


Diagram 5

Given that the areas of the regions marked  $A$  and  $B$  are equal, find the value of the constant  $a$ . [6 marks]

9. Use the graph paper provided to answer this question.

The scientist discovered that the H1N1 virus can be treated with a type of vaccine,  $V$  which is able to control the growth rate,  $P\%$  of the virus, throughout a period of  $X$  hours. The variables  $V$ ,  $P$  and  $X$  are related by the equation  $P = \sqrt{aX^3 + VX}$ , where  $a$  and  $V$  are constants.



$X(\text{hours})$	2	4	6	8	10	12
$P(\%)$	14.42	26.3	40.25	56.9	76.8	98.4

Table 1

- Based on Table 1, construct a table for the values of  $\frac{P^2}{X}$  and  $X^2$ . [1 mark]
- Plot  $\frac{P^2}{X}$  against  $X^2$  by using a scale of 2 cm to 20 unit on the  $X^2$ -axis and 2 cm to 100 units on the  $\frac{P^2}{X}$ -axis. Hence, draw the line of best fit. [4 marks]
- Use the graph in 9(b), find
  - the value of  $a$ ,
  - the growth rate,  $P\%$  estimated by the scientist if  $X = 9$ . [5 marks]



10. (a) Given 70% of the candidates who sat for a driving test have passed the test. In a day, 8 candidates sat for the driving test.
- Calculate the probability that more than one candidate failed the driving test.
  - For the following day, another 8 candidates are sitting for this test. Calculate the probability that exactly 15 candidates passed the driving test in these two days. [5 marks]

- (b) Among 30 000 audience attending a concert, 2 250 of them arrived at the stadium before the door opens, which is at 6:00 p.m.. Assuming that the arrival time of audience is normally distributed with standard deviation of 22 minutes, find
- the mean of arrival time, to the nearest minutes,
  - the number of audience who arrive after 7:00 p.m. [5 marks]

11. Diagram 6 shows a piece of right angled triangle garden in Ziwei's house. She intends to fence the shaded region  $OMN$  to plant flowers. Given that  $AN = AO$  and  $BM = BO$ .

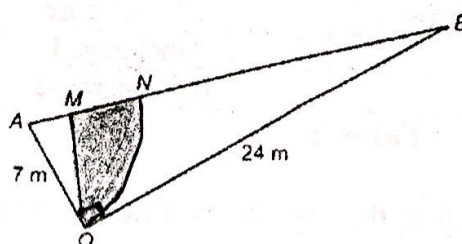


Diagram 6

- Find the length, in m, of  $MN$ . [2 marks]
- Calculate  $\angle OAB$ , in radians. [2 marks]
- Find the length, in m, of the fencing of the shaded region  $OMN$ . [3 marks]
- Calculate the area of the shaded region, in  $m^2$ , for Ziwei to plant flowers. [3 marks]

### Section C

[20 marks]

Answer **any** two questions from this section.

12. Diagram 7 shows Kun Chuan was cycling along a straight line through a fixed point  $O$  during a practice session. His velocity,  $v \text{ ms}^{-1}$ , is given by  $v = 24 + 12t - 3t^2$  where  $t$  is the time, in seconds, after passing through  $O$ .

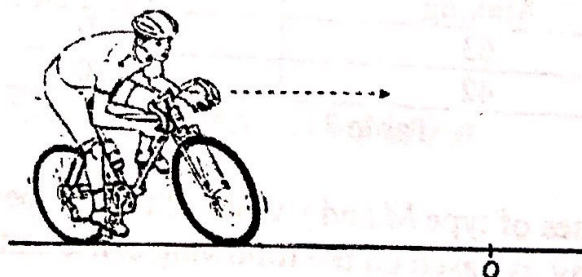


Diagram 7



- (a) Express the displacement function of Kun Chuan's motion, in terms of  $t$ . [2 marks]  
 (b) Find his velocity when  $t = 2.5$  seconds. [2 marks]  
 (c) Find the maximum displacement from the point  $O$  throughout this practice session. [3 marks]  
 (d) Sketch the velocity – time graph of Kun Chuan's motion for  $0 \leq t \leq 7$ . [3 marks]

13. Table 2 shows the price indices of four different materials  $S$ ,  $T$ ,  $U$  and  $V$  in the production of a carton of shampoo  $X$ . It also includes the proportion of usage of materials in the production of the shampoo.

Material	Price index in the year 2012 based on the year 2010	Change of price index from the year 2012 to the year 2016	Weightage
$S$	160	5% increase	4
$T$	120	25% increase	$p$
$U$	80	Unchanged	6
$V$	140	10% decrease	$p + 4$

Table 2

- (a) If the price material  $T$  is RM 70 in the year 2010, find the corresponding price in the year 2012. [2 marks]  
 (b) Find the price indices of all the four materials in 2016 based on 2010. [4 marks]  
 (c) (i) If the composite index for the year 2016 based on the year 2010 is 124.2, find the value of  $p$ .  
 (ii) Hence, find the cost of producing the shampoo in 2018 if the cost of each material is expected to increase by 20% from 2016 to 2018, given the corresponding cost in 2010 is RM 169.20. [4 marks]

14. Use graph paper to answer this question.

A factory produces two types of vases,  $M$  and  $N$ . The production of each type of vases involves two processes; making and painting.

Table 3 shows the time taken to make and paint a vase of type  $M$  and a vase of type  $N$ .

Vase	Time taken ( minutes)	
	Making	Painting
$M$	63	30
$N$	42	70

Table 3

The factory produces  $x$  vases of type  $M$  and  $y$  vases of type  $N$  per day. The production of vases per day is based on the following constraints :

- I : The maximum total time for making both vases is 882 minutes.  
 II : The total time for painting both vases is at least 420 minutes.  
 III : The ratio of the number of vases of type  $M$  to the number of vases of type  $N$  is at least 1 : 2.
- (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 vases on both axes, construct and shade the region  $R$  that satisfies all the above constraints. [3 marks]  
 (c) Using the graph constructed in 14(b), find  
 (i) the minimum number of vases of type  $M$  if 3 vases of type  $N$  are produced per day,  
 (ii) the maximum total profit per day if the profit from 1 vase of type  $M$  is RM15 and from 1 vase of type  $N$  is RM20. [4 marks]

15. **Solutions by scale drawing is not accepted.**

Diagram 8 shows the locations of town  $A$  and town  $B$ .



Diagram 8

Town  $B$  is due north of town  $A$  and the distance town  $A$  and town  $B$  is 12 km. The bearing of town  $C$  from town  $B$  is  $140^\circ$ . The distance between town  $A$  and town  $C$  is 8 km.

- (a) Copy Diagram 8, sketch and mark the possible position for town  $C$  and town  $C'$  where town  $C$  is nearer to town  $B$ . [2 marks]  
 (b) Find  $\angle AC'B$  and  $\angle ACB$ . [3 marks]  
 (c) Calculate the length of  $BC'$ , in km. [2 marks]  
 (d) Find the difference of area  $ABC'$  and the area  $ACC'$ . [3 marks]

**END OF QUESTION PAPER**