TANJONG KATONG SECONDARY SCHOOL
Preliminary Examination 2021
Secondary 4

CANDIDATE NAME	
CLASS		INDEX NUMBER	

MATHEMATICS
Paper 1

Candidates answer on the Question Paper.

4048/01

Wednesday 18 August 2021

2 hours

READ THESE INSTRUCTIONS FIRST

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

Answer **all** questions.
If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
You are expected to use a scientific calculator to evaluate explicit numerical expressions.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

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.

Mathematical Formulae

Compound Interest

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

Mensuration

Curved surface area of a cone $= \pi r \ell$

Curved 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

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

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

1   Circle the irrational number/s from the list below.

1.5π $2.\dot{3}$ $\sqrt{12.1}$ 25.82 [1]

2   Simplify $\sqrt[3]{\left(\dfrac{a^{15}}{b^6}\right)^{-2}}$, leaving your answer in positive indices.
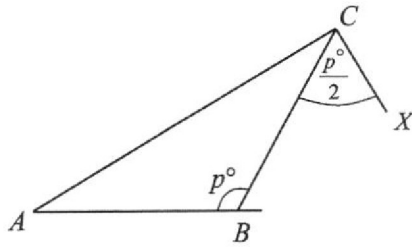
Answer _____ [2]

3   Given that one solution for the equation $\dfrac{1}{2x^2 + kx} = \dfrac{1}{2}$ is $x = -2$, find

(i)   the value of k,

Answer $k =$ _____ [1]

(ii)   a second possible value of x.

Answer $x =$ _____ [1]

4 The diagram shows an isosceles triangle ABC where angle $ABC = p°$ and $BA = BC$.

Point X is such that angle $BCX = \dfrac{p}{2}°$.

D is the intersection of AB extended and CX extended.
John claims that AD will form a diameter of a circle with centre B.
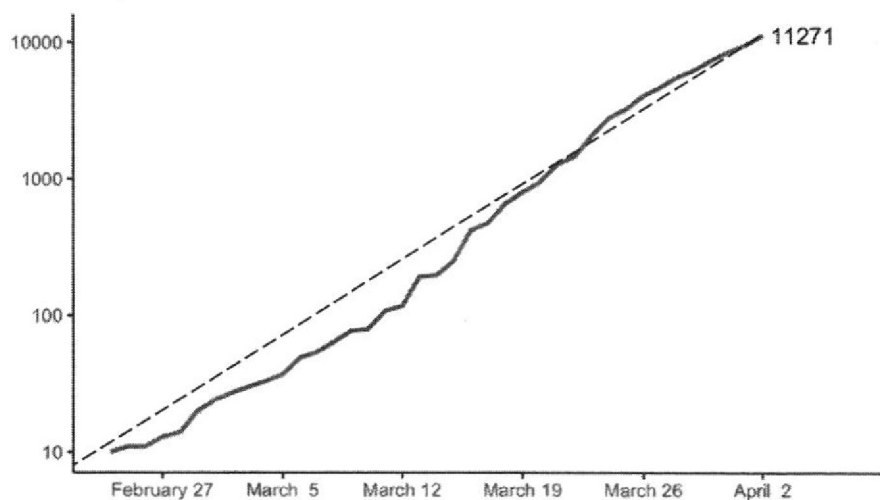Determine whether John's claim is correct or not.
Answer

[2]

---

5 Given that $2m - 1 = (2n + 3)^2$, where n is a positive integer.
Show that m is an integer.
Answer

.

[2]

6   The graph below shows the trend in the number of cases of people infected with the coronavirus in a particular country.
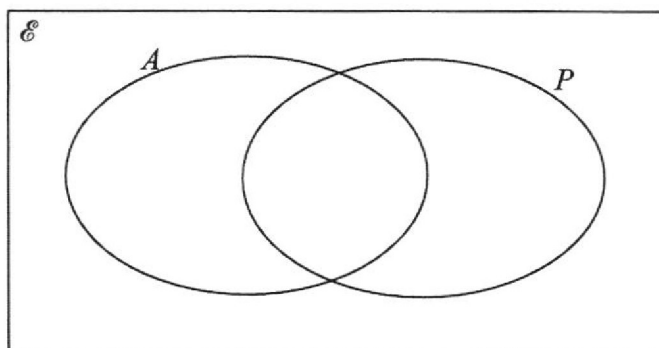

Source: Johns Hopkins University (CSSE)

Jamie claims that the trend shown is approximated by a linear equation of the form $y = 320x$, where x is the number of days and y is the number of infections.
Explain why she is wrong.

*Answer*_____

_____

_____

_____   [1]

7   There are 30 members in a community club.
All the members take up at least one activity, either aqua aerobics or pickleball.
There are 15 members who take up aqua aerobics and 24 who take up pickleball.
Given that A = {members who take up aqua aerobics} and
          P = {members who take up pickleball}
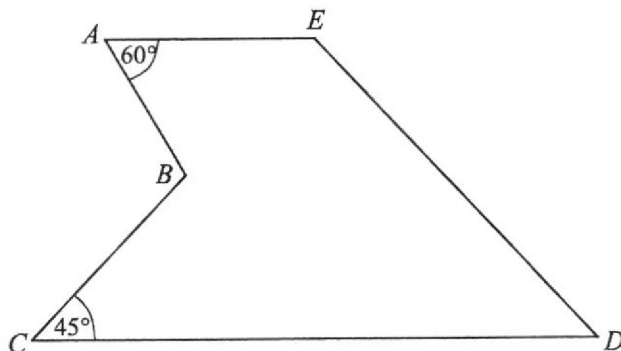Indicate in the Venn Diagram below, showing clearly, the number of members in each subset.

[2]

8 The table shows part of a payment plan for Mr Lee who borrowed $50 000 from a bank when he bought a car.
The bank charges an interest of 2.5% per annum, calculated on a monthly basis.
Mr Lee pays $1 000 at the end of each month.

	Amount owed at beginning of month	Interest for the month	Amount paid at end of month	Amount outstanding at end of month
Month 1	$ 50,000.00	$ 104.17	$ 1,000.00	$ 49,104.17
Month 2	$ 49,104.17	$ 102.30	$ 1,000.00	$ 48,206.47
Month 3	$ 48,206.47	a		
Month 4	b			

Find a and b.

Answer $a = \$$ .... $b = \$$ .... [2]

---

9 In the pentagon *ABCDE* shown, angle *BAE* = 60° and angle *BCD* = 45°.
AE is parallel to *CD*, *E* lies on *CB* extended and *CE* = *DE*.

Find
(i) angle *CED*,

Answer .... ° [1]

(ii) angle *ABC*.

Answer .... ° [1]

Given further that *CD* = 12 cm,
(iii) find the area of triangle *CDE*.

Answer .... cm² [1]

10   A package will leave Australia on 19 August at 21:15, local time in Australia.
      The time taken for the package to arrive at Singapore is 6 hours 30 minutes.
      Australia time is 2 hours ahead that of Singapore time.
      What is the date and time at which the package arrives in Singapore?

      Answer _____ [3]

11   The picture shows a model terracotta warrior.

      The model has height of 15 cm and weighs 20 grammes.
      A similar terracotta warrior has a height of 1.8 metres. Find the weight of the larger terracotta warrior.
      Give your answer in kilogramme, correct to 1 decimal place.

      Answer _____ kg   [3]

12　(a)　The price, P, of an object varies directly as the square of its height, h.
　　　　The price is \$3 when the height is 20 cm.
　　　　Find the price when the height is 30 cm.

Answer　\$ _____　[2]

　　(b)　Given that R varies inversely as the square of T, find the percentage change in R when T is doubled.

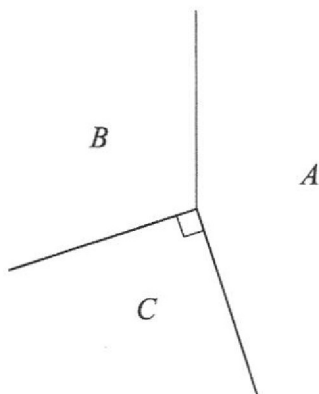*Answer* _____ %　[3]

13　Factorise completely the expressions.
　　(a)　$4(x-y)^2 - 9(x+y)^2$

Answer _____　[2]

　　(b)　$10ax + 15ay - 8bx - 12by$

Answer _____　[2]

14   The diagram shows part of three regular polygons A, B and C fit together at a common vertex. Polygon A is an icosagon, a 20-sided polygon.

What is the special name for polygon B?

Answer -- [4]

15   Given that $x_1, x_2, x_3, \ldots, x_{10}$ are 10 unique numbers whose mean, $\tilde{x}$, is 11.8 and standard deviation is 4.729.

Find the value of

(i) $x_1 + x_2 + x_3 + \ldots + x_{10}$

Answer ---------------------------- [1]

(ii) $x_1^2 + x_2^2 + x_3^2 + \ldots + x_{10}^2$, giving your answer to the nearest whole number.

Answer ---------------------------- [2]

Each of the value of x_n is changed as follows:

If $x_n < \tilde{x}$, then x_n is decreased by 2.

If $x_n > \tilde{x}$, then x_n is increased by 2.

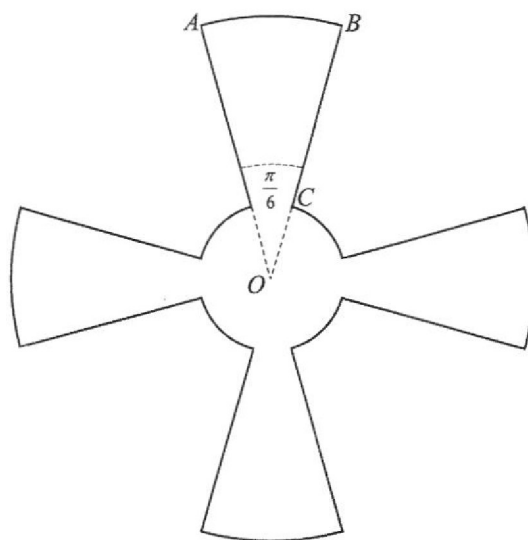(iii) Explain clearly, how this would affect the value of the standard deviation.

Answer ---

--- [2]

16   The diagram shows four identical blades of a fan, whose centre is O. Arc AB on the fan blade forms an angle of $\dfrac{\pi}{6}$ at the centre O. OC is 5 cm and BC is 25 cm.

(i)   Find arc length AB.

Answer _____ cm   [1]

(ii) Find the perimeter of the shape.

Answer _____ cm   [3]

17 (i) Express $x^2 + 6x + 10$ in the form $(x + p)^2 + q$, where p and q are constants to be found.

Answer _____ [1]

(ii) Given that $y = x^2 + 6x + c$, make x the subject of the formula.

Answer _____ [3]

---

18 The stem-and-leaf diagram shows the daily number of customers over a period of one month at Branch A of a Food Outlet.

Branch A

1	0	7	8	9	9		
2	0	1	2	5	5	7	7
3	3	3	3	4	8	9	9	9
4	1	1	2	5	6	7	
5	2	3	4	4			

Key: 4 | 1   means 41 customers

(i) Write down the median of number of customers for Branch A.

Answer _____ [1]

(ii) Find the interquartile range for Branch A.

Answer _____ [2]

(iii) Another branch, Branch B, had a median of 27 customers and an interquartile range of 23 customers. The Food Outlet intends to expand only one of the two branches.
Which one of the two branches should be expanded?
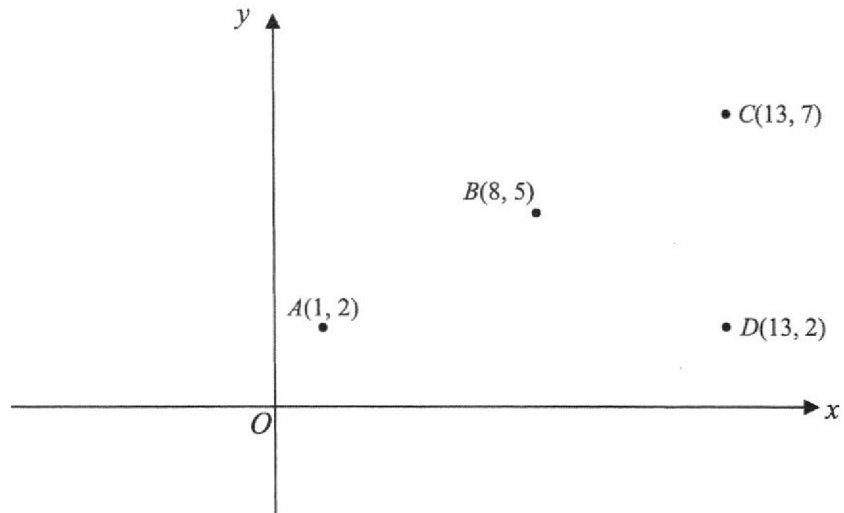Explain your choice clearly.

Answer _____

_____

_____

[1]

_____

[Turn over

19 In the diagram, $A(1, 2)$, $B(8, 5)$, $C(13, 7)$ and $D(13, 2)$ are four points.

(i) Show that $AB + BC = 13.0$, correct to 3 significant figures.

Answer

[2]

(ii) By finding AC, determine the sum of interior angles in figure $ABCD$, justifying your answer.

Answer _____ [3]

20 **(i)** Express 9801 as a product of its prime factors.

Answer _____ [1]

(ii) Hence, explain why 9801 is a square number.

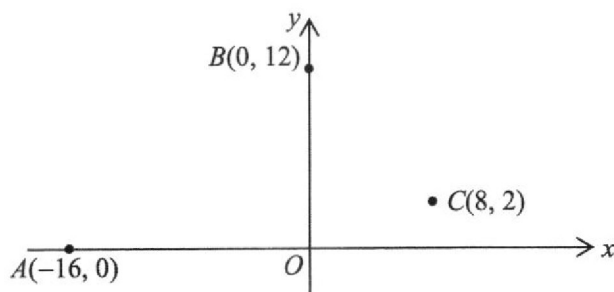*Answer* _____

_____ [1]

(iii) a and b are both prime numbers.

Find the smallest value of a and b such that $9801 \times \dfrac{a}{b}$ is a perfect cube.

Answer $a =$ _____ $b =$ _____ [2]

---

21 The diagram shows three points $A(-16, 0)$, $B(0, 12)$ and $C(8, 2)$.

(i) Find the equation of line AB, expressing your answer in the form $ax + by + c = 0$, where a, b and c are constants to be found.

Answer _____ [2]

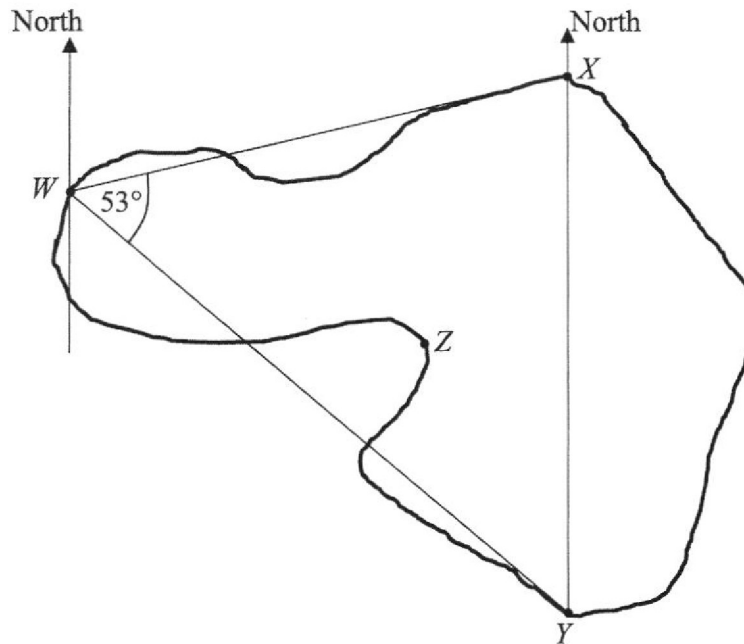A circle is drawn with centre C such that AB is a tangent to the circle.
The perpendicular distance of a point (p, q) from a line $ax + by + c = 0$ is given by the formula

$$\text{Distance} = \frac{ap + bq + c}{\sqrt{a^2 + b^2}}$$

(ii) Using the formula above, determine the radius of the circle.

Answer _____ [2]

22   The diagram shows the positions of four checkpoints W, X, Y and Z in a jungle reserve area.
     The checkpoints are connected by the irregular tracks shown.

X is due north of Y and is on a bearing of $077°$ from W.
Angle $XWY = 53°$ and WY is 60 metres.
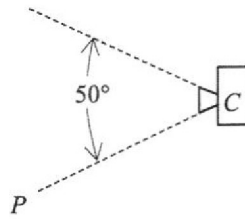
(i)   Calculate the distance XY.

Answer _____ m   [2]

(ii) Given that the bearing of Y from Z is $152°$, write down the bearing of Z from Y.

Answer _____   [1]

(iii) A hidden camera, C, is to be fixed at checkpoint Y to capture animals that move from W to Y via Z, along the irregular track.

The camera has a view angle of $50°$ and can capture anything within this angle.
as shown in the diagram below.

By measurement, determine the minimum bearing where the line CP must be pointed when the camera is fixed at point Y.

Answer _____ [1]

23 Points P, Q and R have coordinates $(1, 1)$, $(5, 11)$ and $(9, 1)$ respectively.
M is the midpoint of QR.

(i) Find the coordinates of point M.

Answer _____ [1]

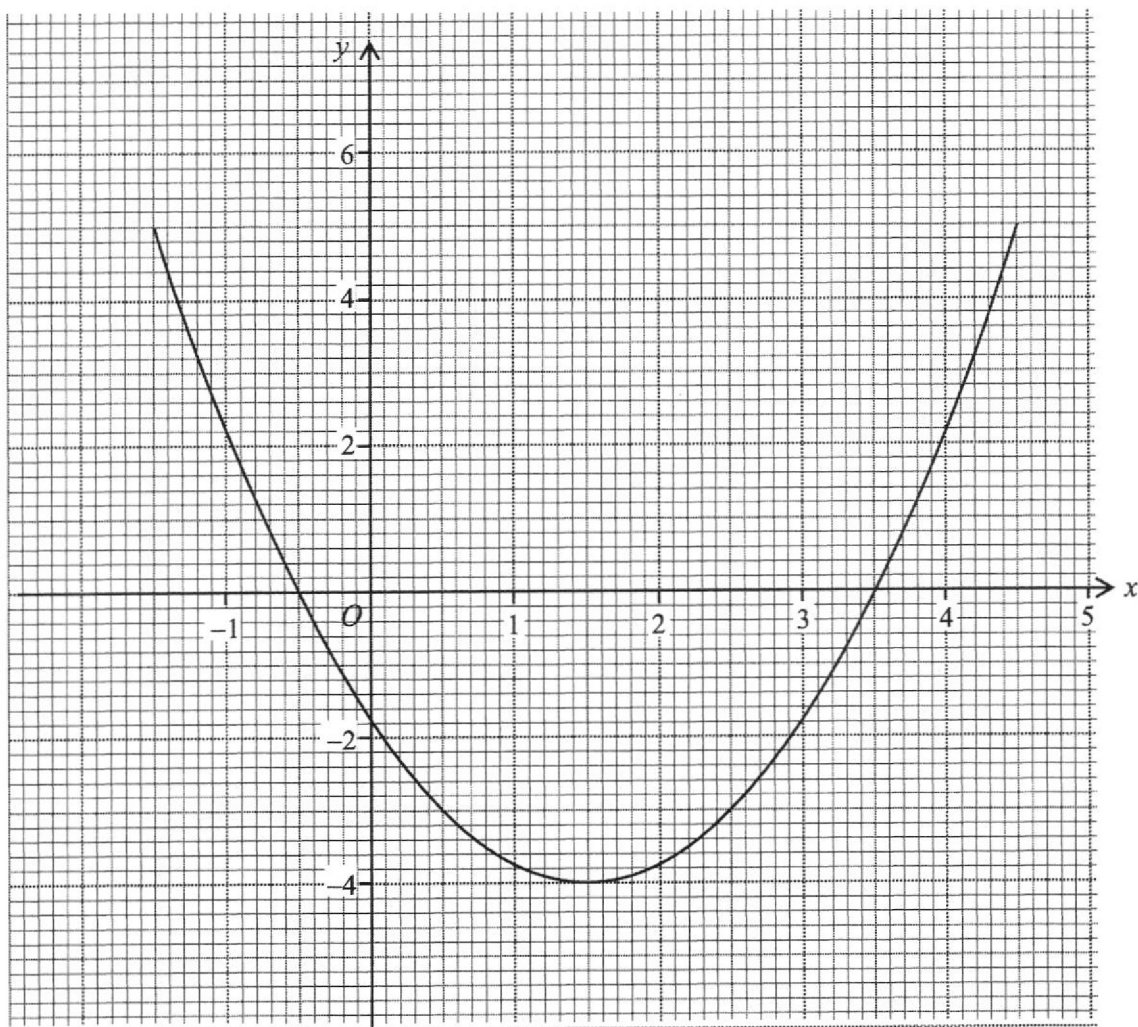(ii) State the gradient of line segment PM.

Answer _____ [1]

(iii) "The line segment PM bisects angle QPR."
Determine whether the statement above is correct or not.
Answer

[2]

24   The graph of $y = x^2 - 3x - 1.75$ is shown on the grids below.

(a) Write down the equation of the line of symmetry.

Answer _____ [1]

(b) Draw the line representing $4y = 7x - 16$ for $-1 \le x \le 5$ on the grids.

[2]

(c) Using the graphs and showing your working clearly, find the solutions of the equation $4x^2 - 19x + 9 = 0$.
Answer

[3]

End of Paper

4048/1/Sec 4 Prelim 2021