ST. MARGARET'S SECONDARY SCHOOL

Preliminary Examinations 2020

CANDIDATE NAME

CLASS REGISTER NUMBER

MATHEMATICS **4048/01**

Paper 1 **17 August 2020**

Secondary 4 Express / 5 Normal (Academic) **2 hours**

Candidates answer on the Question Paper.
Additional Materials: NIL

READ THESE INSTRUCTIONS FIRST

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

Answer **all** the 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.
The use of an approved scientific calculator is expected, where appropriate.
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.

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

For Examiner's Use

This document consists of 20 printed pages.

Mathematical Formulae

Compound Interest

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

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

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

1 **(a)** Arrange the following in ascending order.

$$0.3^2,\ \sqrt{2},\ \frac{1}{\pi},\ 1.34\%$$

__ [1]

(b) Find the difference between $\sqrt{0.25}$ and $\frac{12}{25}$. Express your answer as a fraction in its simplest form.

Answer (b)_____ [1]

2 **(a)** Simplify $\left(\frac{y^3}{6x}\right)^{-1} \times \left(xy^2\right)^2$

Answer (a)_____ [2]

(b) Given that $2^x = 5$, find the value of

(i) 8^x,

Answer (b)(i)_____ [1]

(ii) 2^{1-x}.

Answer (b)(ii)_____ [1]

3 **(a)** Express 198 as a product of its prime factors.

Answer (a) _____ [1]

(b) Given that x and 198 have a lowest common multiple of 990 and highest common factor of 18, find x.

Answer (b) x =_____ [2]

4 Factorise the following completely

(a) $2 - x - 6x^2$,

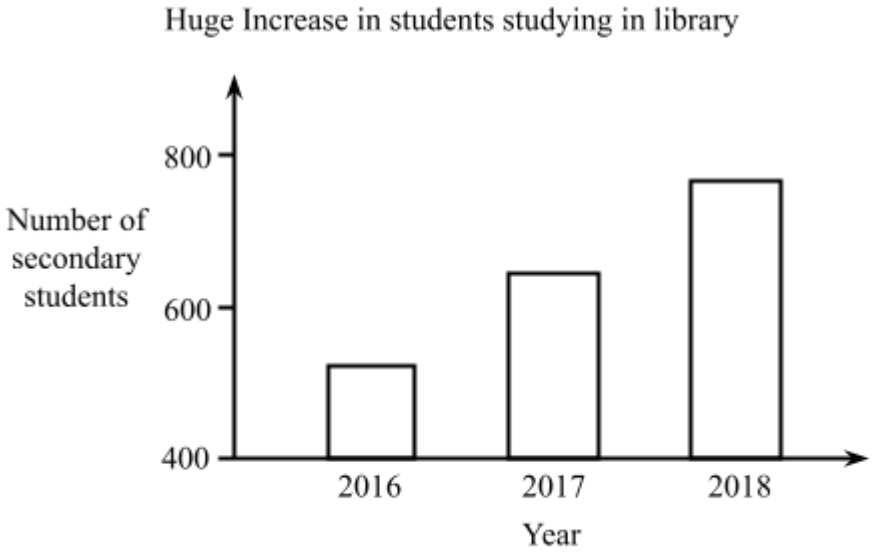
Answer (a) _____ [1]

(b) $9x^2y - 3xy - 3x + 1$.

Answer (b) _____ [2]

5

The graph below shows the number of secondary school students studying in the library between 2016 and 2018.



(a) State one way in which the graph is misleading and explain why it is misleading.

*Answer*_____

_____

_____

_____

_____ [1]

(b) Do you agree that the percentage of secondary school students studying in the library has been increasing between years 2016 to 2018?

Explain your answer.

Answer _____

_____

_____

_____

_____

_____ [2]

6 It is given that

ε = {x : x is an integer and $0 < x \leq 10$ },
A = {x : x is the root of the equation $(x - 5)(x + 4) = 0$},
B = {x : x is a prime number}.

(a) Complete the Venn diagram below to illustrate the above information. [2]



(b) (i) List the elements of the set B'.

Answer (b)(i) B' = _____ [1]

(b) (ii) List the elements of the set $A' \cap B$.

Answer (b)(ii) $A' \cap B =$ _____ [1]

7 Given that p is directly proportional to $(x + 2)$ and $p = 15$ when $x = 1$.

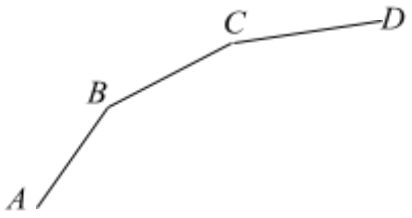
(a) Express p in terms of x.

Answer (a) $p =$ _____ [2]

(b) Find the range of values of x for which $5 \leq p \leq 25$.

Answer (b) _____ [2]

8 AB, BC and CD are adjacent sides of a regular 18-sided polygon.



Find

(a) angle ABC,

Answer (a)_____° [1]

(b) angle *ACB*.

Answer (b)_____° [1]

9 The scale of a map is 8 cm : 2 km.

(a) Write this scale in the form 1 : *n*.

Answer (a) 1 : _____ [1]

(b) A sports complex is represented by an area of 58cm^2 on the map. Calculate the actual area of the sports complex in square kilometres.

Answer (b) _____km^2 [2]

10 $\sqrt{4x^2 - y} = 2x - 3$

Rearrange the formula to make x the subject.

Answer $x =$ _____ [3]

11 The graph of the function $y = ax^2 + bx + c$ passes through the points (2, 4) and (1, 0). The y-intercept of the graph is -2.

(a) Find the values of a, b and c.

Answer (a) $a =$ _____, $b =$ _____, $c =$ _____ [4]

(b) Find the coordinates of the turning point of the graph by completing the square.

Answer (b) (_____, _____) [2]

12 (a) Given that $1.8 : x = \frac{1}{8} : \frac{8}{9}$, find the value of x.

Answer (a) $x =$_____ [1]

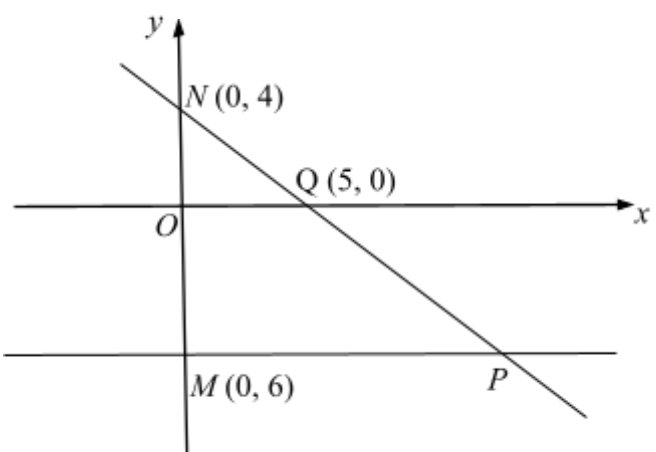
(b) Bacteria in a petri dish multiply at a rate of 9.5 % per hour. At 1 pm, the population of bacteria in the petri dish was 3800.
Find the population of bacteria at 2 pm.

Answer (b) _____ [2]

(c) The marked price of a watch is \$8000. If the watch is sold at the marked price, the retailer gains a profit of 60%. Find the retailer's profit if he sells it at a discount of 20% of the marked price.

Answer (c) \$_____ [2]

13 In the diagram, M is the point $(0, -6)$ and N is the point $(0, 4)$.
The line MP is parallel to the x-axis and line NP cuts the x-axis at $Q(5, 0)$.



(a) State the equation of line *MP*.

Answer (a) _____ [1]

(b) Find the equation of line *NP*.

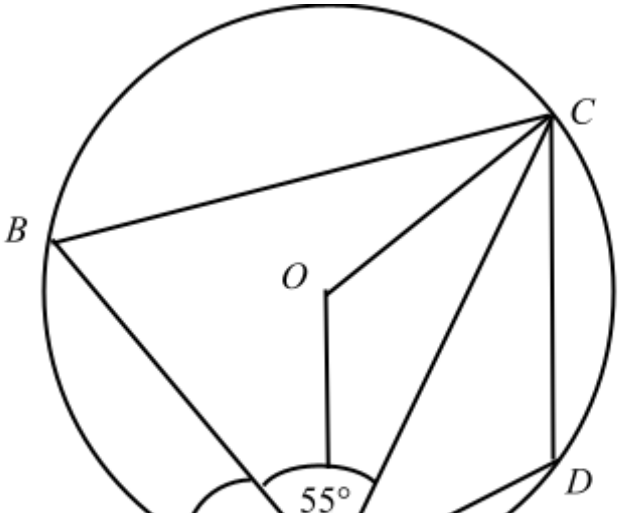
Answer (b) _____ [2]

(c) Find the coordinates of *P*.

Answer (c) (_____, _____) [2]

14 The diagram shows a circle, *ABCD*, with centre *O*. *EA* is a tangent to the circle.

Angle $BAE = 61^{\circ}$ and angle $BAC = 55^{\circ}$.





Find,

(a) angle *BAO,*

Answer (a) _____° [1]

(b) angle *AOC,*

Answer (b) _____° [2]

(c) angle *ABC*,

Answer (c) _____° [1]

(d) angle *CDA*.

Answer (d) _____° [1]

15 Two similar solid cones made of the same material have volumes 216 cm^3 and 343 cm^3. Given that the base radius of the larger cone is 14 cm, find

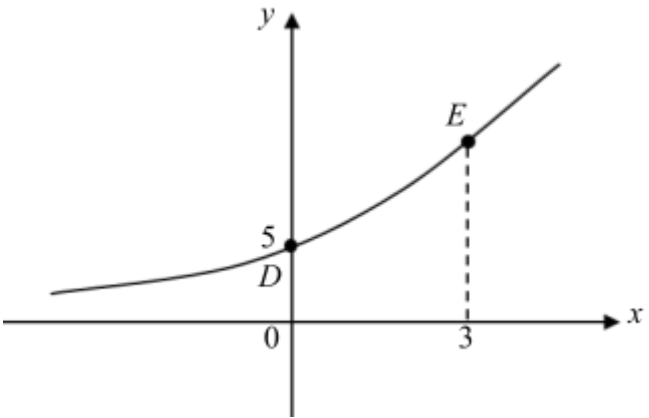
(a) the base radius of the smaller cone,

Answer (a) _____ cm [2]

15 **(b)** the ratio surface area of the smaller cone : surface area of the larger cone, giving your answer to the lowest term.

Answer (b)_____ :_____ [1]

16 The sketch shows the graph of $y = 2^x + h$. The graph cuts the *y*-axis at *D*, and *E* is on the graph where $x = 3$.



(a) Find the value of h.

Answer (a) $h =$ _____ [1]

(b) Find the y-coordinate of point E.

Answer (b) _____ [1]

17 The results of 19 students in a Mathematics test and 22 students in a Science test are shown in the stem-and leaf diagram.

Mathematics Test						Science Test				
		9	7	3	0					
8	7	5	4	2	1	4	4	6	7	9
	8	8	6	6	2	2	3	6	8	9
	7	5	4	0	3	3	3	5	7	8
		x	5	1	4	1	4	6	7	
					5	0	3	3		

Key : 2 | 1 | 4 means a mark of 12 for Mathematics test and a mark of 14 for Science test.

(a) Write down the median mark for the Science test.

Answer (a)_____ [1]

(b) The range of the marks for Mathematics test is 43. Find the value of x.

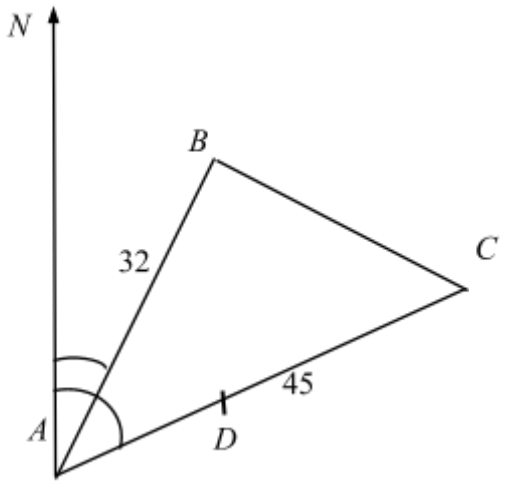
Answer (b)_____ [1]

(c) The two statements below compare the Mathematics test and the Science test. For each statement, write whether you agree or disagree, giving a reason for each answer.

Statement	Agree/Disagree	Reason
The students performed better in the Mathematics test than in the Science test.		
The students' performance is more consistent in the Mathematics test than in the Science test.		

[2]

18 In the diagram, A, B and C represent three buildings. B is 32 km from A on a bearing of 030^o and C is 45 km from A on a bearing of 070^o.



(a) Calculate the bearing of A from B.

Answer (a)_____° [1]

(b) Calculate the distance of *C* from *B*.

Answer (b)_____km [3]

(c) A cyclist leaves *A* at 12.40 pm and cycled directly to *D* at a steady speed of 10 km/h.

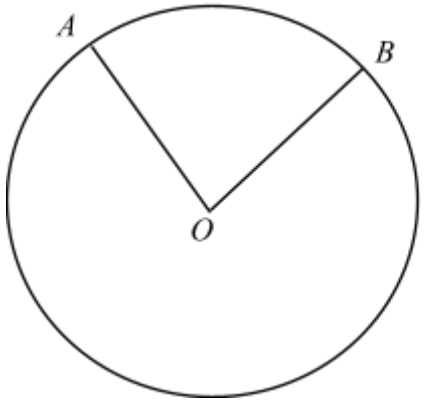
(i) When the cyclist is at *D* which is due south of *B*, calculate the distance *AD*.

Answer (c)(i)_____km [2]

(ii) Hence, find the time, to the nearest minute, at which the cyclist reaches *D*.

Answer (c)(ii)_____ [2]

19 In the figure, the area of the minor sector AOB is $\frac{11}{48}$ of the area of the circle.



(a) Show that angle AOB = 1.4399 radians.

[1]

(b) Given that the area of the minor sector OAB is 39 cm^2, find the radius of the circle.

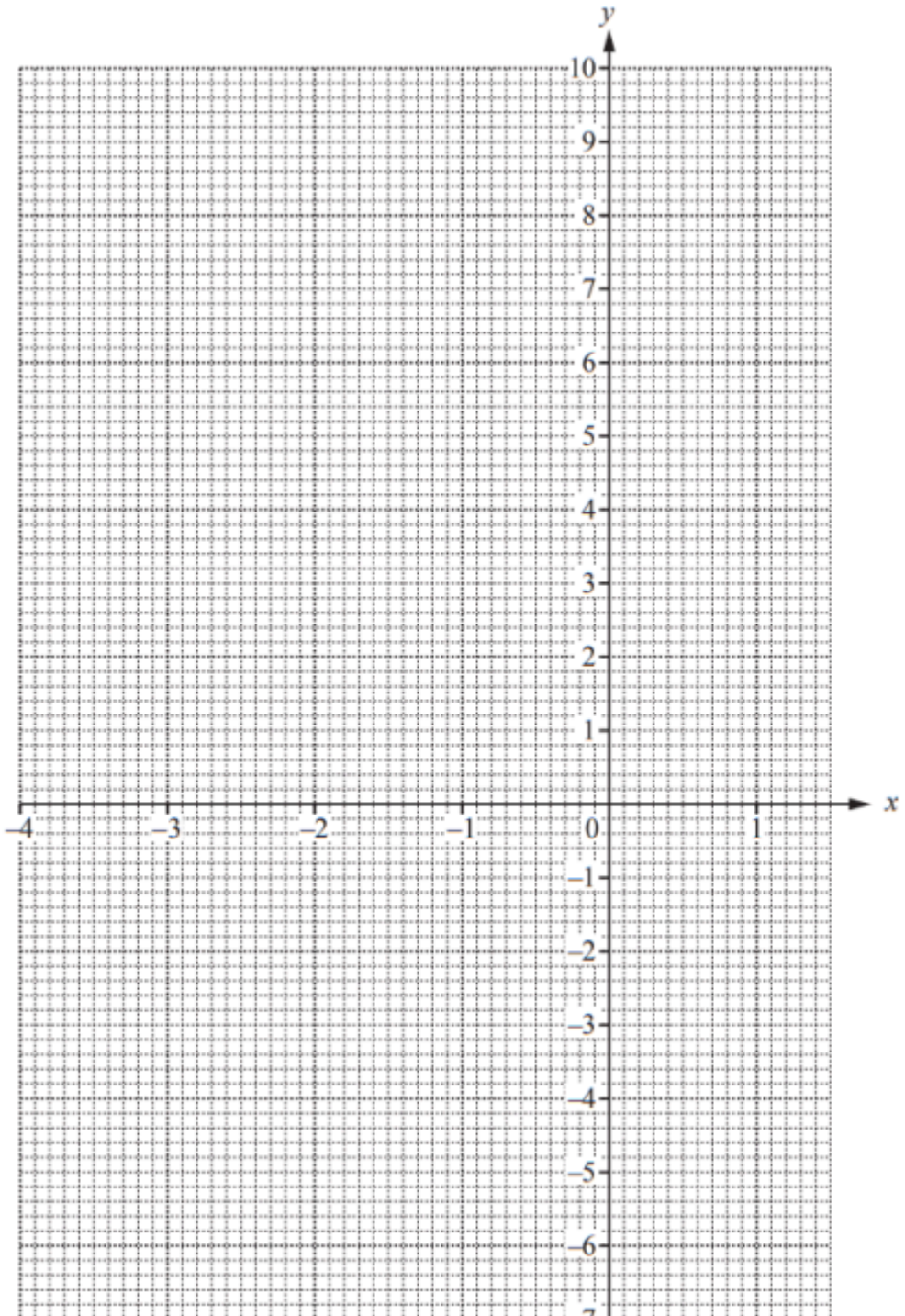
Answer (b) _____cm [2]

20 The table shows some values of $y = 2x^2 + 5x - 3$ for $-4 \leq x \leq 1.5$.

x	−4	−3	−2	−1	0	1	1.5
y	9	0	−5		−3	4	9

(a) Complete the table. [1]

(b) On the grid, draw the graph of $y = 2x^2 + 5x - 3$ for $-4 \leq x \leq 1.5$. [2]



(c) Explain why the equation $2x^2 + 5x - 3 = k$ does not have solutions for some values of k.

_____

_____

_____

_____

_____ [1]

(d) The equation $2x^2 + 3x - 7 = 0$ can be solved by drawing a suitable straight line on the grid.

(i) Find the equation of the straight line.

Answer (d)(i)_____ [1]

(ii) By drawing this straight line, solve the equation $2x^2 + 3x - 7 = 0$

Answer (d)(ii) x =_____or _____ [3]