Calculator Model:

ORCHID PARK SECONDARY SCHOOL
Mid-Year Examination 2018

CANDIDATE NAME				
CLASS			INDEX NUMBER	

MATHEMATICS **4048**

Papers 1 & 2 **4 May 2018**

Secondary 2 Express **2 hours 30 minutes**

Setter: Mr Benny Leong & Mr Wong Yiu Hang **100 Marks**

Additional Materials: Writing Papers, Graph Paper and Answer Cover Page

READ THESE INSTRUCTIONS FIRST

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

Section A
Answer **all** questions in the **spaces** provided in the question paper.
Section B
Answer **all** questions in the **writing papers** provided.

If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
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 marks for this paper is **100.**

For Examiner's Use	
Total	

Mathematical Formulae

Compound interest

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

Mensuration

$$\text{Curved surface area of a cone} = \pi rl$$

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

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

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

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

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

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

Trigonometry

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

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

Statistics

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

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

Section A (50 marks)

Answer **all** the questions.

1 **(a)** Calculate $\frac{62.33^2+38.2}{0.3141+\sqrt{579}}$.

Write down all the figures on your calculator display.

Answer ……. [1]

(b) Write your answer to **part (a)** correct to 3 significant figures.

Answer ……. [1]

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2 **(a)** Alvin's age is 6 years less than $\frac{1}{2}$ times the present age of Ben. If Ben is x years old now, express, in terms of x, Alvin's present age.

Answer ……. [1]

(b) John made a statement that a bicycle travelling at 20 km/h is as fast as a motorcycle travelling at 20 m/s. Is the statement made by John correct? Justify your answer.

Answer ……

……. [2]

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3 **(a)** Express 2160 as the product of its prime factors in index notation.

Answer ……. [1]

(b) Using your answer in part (a) find the smallest k such that $2160k$ is a perfect square.

Answer k = …..……. [1]

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4 y is directly proportional to $(2x - 2)$. Given $x = 10$, $y = 36$

(a) Write an equation connecting x and y.

Answer ……. [2]

(b) Find the value of y when $x = 3$

Answer y = …..……. [1]

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5 Solve the following simultaneous equations

$3x - 2y = 12$

$5x - 3y = 21$

Answer x = ……..…… , y = …… [3]

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6 Simplify the following expressions.

(a) $(2x + 3y)^2$,

Answer ……. [2]

6 **(b)** $(x + 2) - (2x - 4)(x - 3)$

Answer ……. [3]

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7 One of the solution of $x^2 - kx - 20 = 0$ is $x = 5$. Find

(a) the value of k,

Answer k = ……. [1]

(b) the other solution of the equation.

Answer x = ……. [2]

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8 **(a)** Factorise $x^2 - 16$.

Answer ……. [1]

(b) **Hence**, find the 2 factors of 3584, other than 1 and 3584

Answer …… and ……. [2]

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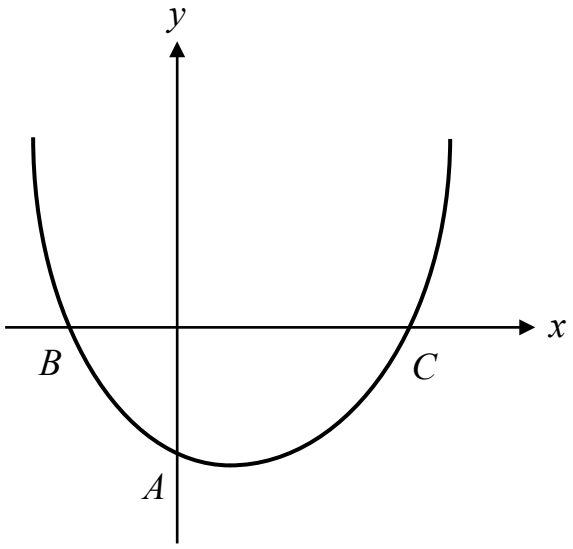
9 The diagram below shows the graph of $y = x^2 - x - 12$.



(a) The graph cuts the x – axis at B and C. Find the coordinates of B and C.

Answer B (…… , ……) [1]

Answer C (…… , ……) [1]

(b) Find the gradient of line AC.

Answer …… [2]

(c) Find the equation of the line of symmetry.

Answer …… [1]

10 Make r the subject of the formula $v = \frac{1}{3}\pi r^2 h$.

Answer …….…….. [3]

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11 Factorise the following expressions.

(a) $3xy^2 - 18x^2y$,

Answer …….…….. [1]

(b) $10xy - 20x + 5y^2 - 10y$.

Answer …….…….. [2]

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12 Simplify the following expressions.

(a) $\frac{7b^2}{35ab}$,

Answer …….…….. [1]

(b) $\frac{2a}{3bc} \div \frac{4a^2b}{abc^2}$.

Answer …….…….. [1]

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13 Solve $\frac{2x+2}{3x+1} = 4x$

Answer x = ……..…… or ……..……. [3]

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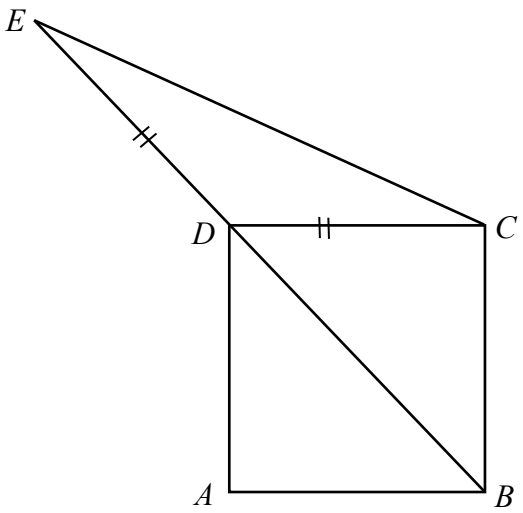
14 Express the $\frac{10}{6x^2-7x+2} - \frac{3}{2x-1}$ as a single fraction in its simplest form.

Answer …….……. [3]

15 In the figure, *ABCD* is a square, *BDE* is a straight line and *CDE* is an isosceles triangle in which *CD* = *DE*. Show your reason(s) clearly, find



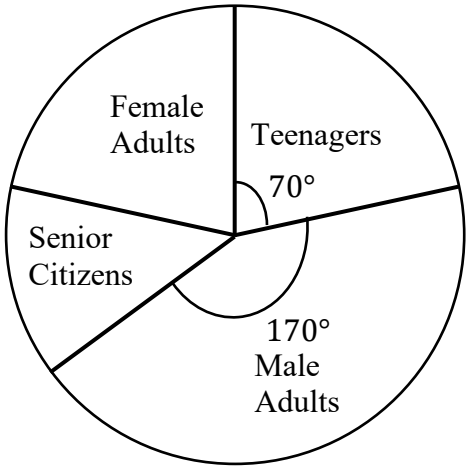
(a) angle *BDC*

Answer ……° [1]

(b) angle *DCE*

Answer ……° [2]

16 The pie chart shows the distribution of different age groups in a marathon with 2520 participants. The number of female adult participants is twice the number of senior citizens participants.



(a) Find the size of the angle representing the senior citizen participants in the pie chart.

Answer ……° [2]

(b) Find the number of female adult participants in the marathon.

Answer …… [2]

Section B (50 marks)

Answer **all** the questions.

17 **(a)** The total thickness, x cm, is directly proportional to the number of books, n. The total thickness for 12 books is 90 cm.

(i) Find an equation connecting x and n. [2]

(ii) What is the meaning of the constant k in the equation in part **(a)**? [1]

(iii) **Hence**, find the number of books that has a total thickness of 262.5 cm. [1]

(b) 6 taps will fill 12 tanks in 8 minutes. How many taps does it take to fill 15 tanks in 30 minutes? [2]

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18 **(a)** It is given that a school bus can take a maximum of 44 passengers each trip. There are 7 classes of 40 students each in Secondary Two cohort.

(i) By setting up an inequality, find the minimum number of school buses that are needed to take the whole Secondary Two cohort for cross country at MacRitchie Reservoir. [3]

(ii) How many extra seats will there be if the number of buses found in the answer of part **(i)** is being booked? [1]

(b) **(i)** Solve the equation $3x^2 + x - 10 = 0$. [2]

(ii) **Hence**, solve the equation $3(p + 3)^2 + (p + 3) - 10 = 0$ [2]

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19 **(a)** A rectangle has an area of $12x^2 + 13x - 14$ cm^2. Given that the length of the rectangle is $4x + 7$ cm, find the width of the rectangle in terms of x. [2]

(b) **(i)** Factorise the expression $2x^2 + 15x + 28$. [2]

(ii) By observing, find the value of x such that $2x^2 + 15x + 28 = 21528$. [1]

(iii) **Hence**, using your answer from part **(i)** and **(ii)**, find two factors of 21528 that is larger than 100. [2]

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20 **(a)** In 2018, it was announced that the Goods and Service Tax will be increased from 7% to 9% after 2021. A student bought a laptop for \$2033 in 2018.

(i) Find the price of the laptop before GST. [2]

(ii) How much extra does the student need to pay if he buys the same laptop after the increase of GST, assuming that the price of the laptop remains the same? [2]

(b) A computer desktop is priced as follows:

CPU	\$950
Monitor	\$350
Keyboard	\$50
Mouse	\$40

(i) Find the total selling price of the computer desktop. [1]

(ii) The computer can be bought using a hire purchase with a deposit of 20% of the total selling price. The remaining amount can be paid by installment over 24 months with an interest of 15% per annum. Find the monthly payment, rounding off your answer to the nearest cent. [3]

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21 **(a)** Each exterior angle of Polygon S is 11.25°,

(i) find the number of sides of Polygon S. [1]

(ii) find the sum of interior angles of Polygon S. [1]

(iii) Another Polygon Q has the same number of sides as Polygon S. Two of the exterior angles of Polygon Q add up to 60^o, and each of the remaining exterior angle, x is the same. Find the value of x. [2]

(b) If 3 is subtracted from the numerator and 1 is subtracted from the denominator of a fraction, the value obtained is $\frac{1}{2}$.

If 1 is added to the numerator and 3 is added to the denominator of a fraction, the value obtained is $\frac{2}{3}$.

(i) Let x be the numerator and let y be the denominator of the fraction. Form 2 equations using the information above. [2]

(iii) **Hence**, find the fraction. [3]

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22 Answer the whole of this question on a sheet of graph paper.

The amount of profit or loss made by a cake shop for making and selling whole birthday cakes each day is represented by the function $y = -2x^2 + 73x - 390$, where y is the profit or loss and x is the number of cakes sold. Some values of x and the corresponding values of y are given in the table below.

x	0	5	10	15	20	25	30	35
y	-390	-75	p	255	270	185	q	-285

(a) Find the values of p and q. [2]

(b) On a sheet of graph paper, using a scale of 2 cm to represent 5 units on the x-axis and 2 cm to represent 100 units on the y-axis, draw the graph of $y = -2x^2 + 73x - 390$ for $0 \leq x \leq 35$. [3]

(c) Use your graph in **(b)** to find

(i) the profit if 12 cakes are sold. [1]

(ii) the daily operating cost of opening the cake shop. [1]

(iii) the minimum number of cakes to be sold for the company to break even. (Break even refers to the point where there is no profit or loss) [1]

(d) Suggest a possible reason why the profit of the cake shop decreases when more than 20 cakes are sold. [1]

(e) Company *A* urgently needs to order 40 cakes for an event and is willing to top up $1000 in addition to the original price of the cakes while company *B* wants to order 22 cakes for a birthday party.

Given that the cake shop only have enough resources to accept one order, which order should the cake shop accept? Explain your reasoning with clear workings. [3]

--- END OF PAPER ---