2 5

Marsiling Secondary School

End-of-Year Examination 2016

Subject: Mathematics Paper 1 Level: Sec 2 Stream: Express

Date: 14 October 2016 Duration: 1 hour 30 minutes

Name: _____ Index No: _____ Class: _____

Additional Material: NIL

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on the cover page.
Write in dark blue or black ink in the spaces provided on the Question Paper.
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 in the space below that question.
Omission of essential working will result in loss of marks.
Calculator should be used 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 of the marks for this paper is 60.

FOR EXAMINER'S USE	
TOTAL	/ 60

Setter : Mr Phua Kian Wee

This question paper consists of 14 printed pages, including the cover page.

Mathematical Formulae

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 = $\frac{4}{3}\pi r^3$

Answer all the questions.

1 (a) Calculate $\dfrac{5+\sqrt{99-3\times(-2)}}{3+\pi}$.

Write down the first five digits on your calculator display.

Answer (a) ..... [1]

(b) Write your answer to part (a) correct to 3 decimal places.

Answer (b) ..... [1]

2 The number of students who sat for the Primary School Leaving Examination in 2014 was 42 300 when rounded off to the nearest hundred.

Write down

(a) the least possible value of the number of students,

Answer (a) ..... [1]

(b) the greatest possible value of the number of students.

Answer (b) ..... [1]

The size of each interior angle of a regular polygon is three times the size of each exterior angle.

Find the number of sides that the polygon has.

Answer ..... [2]

4 (a) Express 504 as the product of its prime factors.

Answer (a) .. [1]

(b) Find the greatest integer that will divide both 504 and 630 exactly.

Answer (b) [1]

(c) Find the smallest positive integer k such that $\frac{504}{k}$ is a square number.

Answer (c) $k =$ [1]

5 Write as a single fraction in its simplest form

(a) $\frac{5x-1}{4}+\frac{x+2}{3}$,

Answer (a)

(b) $\frac{7x}{x^2-9}+\frac{4}{x+3}$.

Answer (b) ..... [2]

6 A metal pipe is 35 cm long.
Nigel cuts the pipe into two parts so that the ratio of the lengths is 5 : 2.

(a) Calculate the difference in length between the two parts of the pipe.

Answer (a) ..... cm [2]

(b) Nigel cuts a certain length of pipe, x cm, from each of the two parts on the pipe.
The ratio of the remaining lengths is 6 : 1.

Calculate the value of x.

Answer (b) x = ... [2]

7 Joseph bought an oil painting for $950.
He sold it five years later for a profit of 120% of the cost price.

Calculate the selling price.

Answer $ ..... [2]

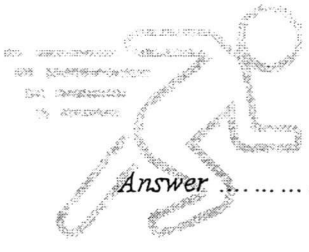
8 The fastest speed attained by a car powered by biogas was 364.6 km/h.

Convert 364.6 km/h into m/s.
Give your answer correct to three significant figures.

Answer .... m/s [2]

9 It is given that $y = \dfrac{x-2}{x}$.

Express x in terms of y.



Answer .... [2]

10 Expand and simplify $(5x-3)^2$.

Answer ..... [2]

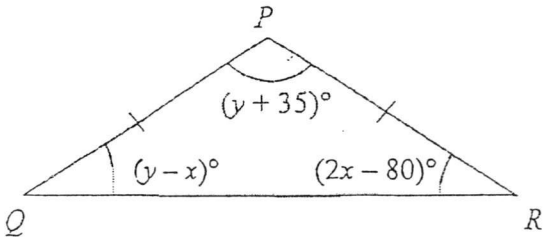
11 (a) Factorise $6a+3ay-4b-2by$.

Answer (a) ... [2]

(b) Factorise fully $6x^3-27x^2+30x$.

Answer (b) .. [2]

12 Triangle PQR is isosceles with $PQ = PR$.
The angles are as shown on the diagram.



(a) Write down two simultaneous equations, in terms of x and y, to represent this information.

Answer (a) ... .. [2]

(b) Solve these two equations to find the value of x and the value of y.

Answer (b) x = ...

y = ... [3]

For Examiner's Use

13 f is directly proportional to the square root of T.
When $f = 8$, $T = 16$.

(a) Find an equation connecting f and T.

Answer (a) ..... [2]

(b) Find the value of f when this value of T is halved.

Answer (b) ..... [2]

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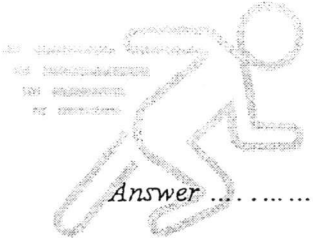
How many more workers are needed if they need to clean up the stadium in 4 hours?



Answer ..... [2]

15 $\xi = \{\text{integers } x : 0 \leq x < 10\} = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$
$A = \{\text{prime numbers}\} = \{2, 3, 5, 7\}$
$B = \{\text{multiples of 3}\} = \{3, 6, 9\}$

(a) List all the elements in $A \cap B$.

Answer (a) ..... [1]

(b) Find $n(A' \cup B)$.

Answer (b) ..... [1]

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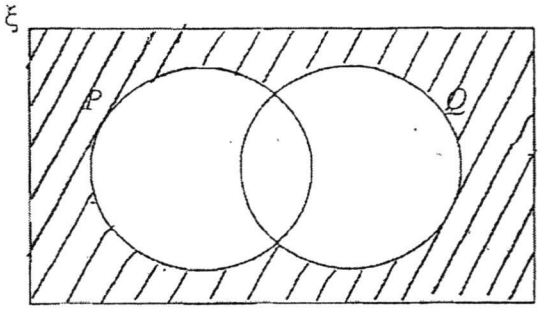
16 On the Venn diagram, shade the region which represents $(P \cup Q)'$.



[1]

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17 A class of 14 girls and 26 boys took a quiz.
The mean mark for the girls was 27.
The mean mark for the boys was 26.5.

Find the mean mark for the whole class.

Answer ..... [2]

---

18 One solution of the equation $x^2 + bx - 6 = 0$, where b is a constant, is $x = -2$.

(a) Find the value of b.

Answer (a) $b =$ ..... [1]

(b) Hence, find the second solution of the equation.

Answer (b) $x =$ ..... [1]

19 The table below summarises the number of watches that a group of students have.

Number of watches	0	1	2	3
Frequency	2	7	x	5

(a) Write down the largest possible value of x if the mode is 1.

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

(b) Write down the value of x if the median is 1.5.

Answer (b) $x =$ ..... [1]

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

For Examiner's Use

Answer all the questions.

1 (a) Calculate $\frac{5+\sqrt{99-3\times(-2)}}{3+\pi}$.

Write down the first five digits on your calculator display.

Answer (a) 2.4825 [1] [B1]

(b) Write your answer to part (a) correct to 3 decimal places.

Answer (b) 2.483 [1] [B1]

---

2 The number of students who sat for the Primary School Leaving Examination in 2014 was 42 300 when rounded off to the nearest hundred.

Write down

(a) the least possible value of the number of students,

Answer (a) 42 250 [1] [B1]

(b) the greatest possible value of the number of students.

Answer (b) 42 349 [1] [B1]

---

3 The size of each interior angle of a regular polygon is three times the size of each exterior angle.

Find the number of sides that the polygon has.

$\frac{(n-2)\times 180^\circ}{n} = 3\left(\frac{360^\circ}{n}\right)$ [M1]

Let x be the size of each ext. $\angle$

$3x + x = 180^\circ$ [M1]

$4x = 180^\circ$

$x = 45^\circ$

$\therefore n = \frac{360^\circ}{45^\circ}$

$= 8$

or

$(n-2)\times 180^\circ = 1080^\circ$

$n-2 = \frac{1080^\circ}{180^\circ}$

$= 6$

$\therefore n = 8$ #

Answer 8 [2] [A1]

Accept guess-and-check method

For Examiner's Use

4 (a) Express 504 as the product of its prime factors.

$$\begin{array}{r|l} 2 & 504 \\ 2 & 252 \\ 2 & 126 \\ 3 & 63 \\ 3 & 21 \\ 7 & 7 \\ & 1 \end{array}$$

Answer (a) $2^3 \times 3^2 \times 7$ [1] [B1]

(b) Find the greatest integer that will divide both 504 and 630 exactly.

$$\begin{array}{r|ll} 2 & 504 & 630 \\ 3 & 252 & 315 \\ 3 & 84 & 105 \\ 7 & 28 & 35 \\ & 4 & 5 \end{array}$$

HCF $= 2 \times 3 \times 3 \times 7$

$= 126$

Answer (b) 126 [1] [B1]

(c) Find the smallest positive integer k such that $\frac{504}{k}$ is a square number.

$$\frac{2^3 \times 3^2 \times 7}{k} = 2^2 \times 3^2$$

$\therefore k = 2 \times 7$

$= 14$

Answer (c) $k =$ 14 [1] [B1]

For Examiner's Use

5 Write as a single fraction in its simplest form

(a) $\frac{5x-1}{4}+\frac{x+2}{3}$,

$$\frac{3(5x-1)+4(x+2)}{12} \quad [M1]$$

$$= \frac{15x-3+4x+8}{12}$$

$$= \frac{19x+5}{12}$$

Answer (a) $\frac{19x+5}{12}$ [2] [A1]

(b) $\frac{7x}{x^2-9}+\frac{4}{x+3}$.

$$\frac{7x+4(x-3)}{(x+3)(x-3)} \quad [M1]$$

$$= \frac{7x+4x-12}{(x+3)(x-3)}$$

$$= \frac{11x-12}{(x+3)(x-3)}$$

or $\frac{7x(x+3)+4(x^2-9)}{(x^2-9)(x+3)}$

$$= \frac{7x^2+21x+4x^2-36}{(x^2-9)(x+3)}$$

$$= \frac{11x^2+21x-36}{(x^2-9)(x+3)}$$

$$= \frac{(11x-12)(x+3)}{(x^2-9)(x+3)} \quad [M1]$$

$$= \frac{11x-12}{x^2-9} \quad [A1]$$

Answer (b) $\frac{11x-12}{(x+3)(x-3)}$ [2] [A1]

6 A metal pipe is 35 cm long.
Nigel cuts the pipe into two parts so that the ratio of the lengths is 5 : 2.

(a) Calculate the difference in length between the two parts of the pipe.

Difference $= \frac{35}{7} \times (5-2)$ [M1]

$= 15$

Answer (a) 15 cm [2] [A1]

(b) Nigel cuts a certain length of pipe, x cm, from each of the two parts on the pipe.
The ratio of the remaining lengths is 6 : 1.

Calculate the value of x.

Length of longer pipe $= \frac{35}{7} \times 5 = 25$

Length of shorter pipe $= \frac{35}{7} \times 2 = 10$

$\frac{25-x}{10-x} = \frac{6}{1}$ [M1]

$25 - x = 6(10-x)$

$= 60 - 6x$

$5x = 60 - 25$

$= 35$

$\therefore x = 7$

Answer (b) $x =$ $\frac{7}{1}$ [2] [A1]

---

7 Joseph bought an oil painting for $950.
He sold it five years later for a profit of 120% of the cost price.

Calculate the selling price.

Profit $= \frac{120}{100} \times \$950$ or $\frac{220}{100} \times \$950$ [M1]

$= \$1140$ $= \$2090$

Selling price

$= \$950 + \$1140$ [M1]

$= \$2090$

Answer $ 2090 [A1] [2]

For Examiner's Use

8 The fastest speed attained by a car powered by biogas was 364.6 km/h.

Convert 364.6 km/h into m/s.
Give your answer correct to three significant figures.

$\frac{364.6 \times 1000 \text{ m}}{3600 \text{ s}}$ [M1] or $\frac{364.6}{3.6}$ [M1]

≈ 101 m/s (to 3 s.f.)

Answer 101 m/s [2] [A1]

---

9 It is given that $y = \frac{x-2}{x}$.

Express x in terms of y.

$xy = x - 2$ [M1]

$xy - x = -2$ or $2 = x - xy$

$x(y-1) = -2$ $2 = x(1-y)$

$\therefore x = \frac{-2}{y-1}$ [A1] $x = \frac{2}{1-y}$ [A1]

Answer $x = \frac{2}{1-y}$ [A1] [2]

or $x = \frac{-2}{y-1}$ [A1]

For Examiner's Use

10 Expand and simplify $(5x-3)^2$.

$(5x-3)(5x-3)$ or

$= 25x^2 - 15x - 15x + 9$ [M1] $(5x)^2 - 2(5x)(3) + 3^2$ [A1]

$= 25x^2 - 30x + 9$

Answer $25x^2 - 30x + 9$ [2] [A1]

---

11 (a) Factorise $6a + 3ay - 4b - 2by$.

$6a - 4b + 3ay - 2by$

$= 2(3a - 2b) + y(3a - 2b)$ [M1]

$= (3a - 2b)(2 + y)$

or $6a + 3ay - 4b - 2by$

$= 3a(2 + y) - 2b(2 + y)$ [M1]

Answer (a) $(3a-2b)(2+y)$ [2] [A1]

(b) Factorise fully $6x^3 - 27x^2 + 30x$.

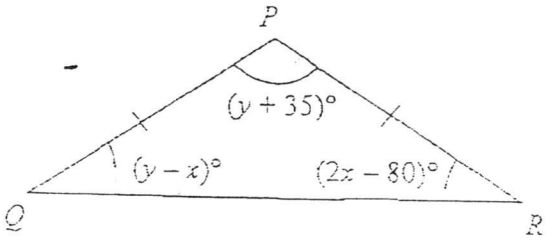
$3x(2x^2 - 9x + 10)$ [M1] or $x(6x - 15)(x - $

$= 3x(2x - 5)(x - 2)$ or $x(2x - 5)(3x - $

Answer (b) $3x(2x-5)(x-2)$ [2] [A1]

For Examiner's Use

12 Triangle PQR is isosceles with $PQ = PR$.
The angles are as shown on the diagram.



(a) Write down two simultaneous equations, in terms of x and y, to represent this information.

$y - x = 2x - 80$, $\quad y + 35 + y - x + 2x - 80 = 180$

$y = 3x - 80$ $\quad 2y + x - 45 = 180$

$2y = 225 - x$

Answer (a) $y = 3x - 80$ [B1]

$2y = 225 - x$ [2] [B1]

(b) Solve these two equations to find the value of x and the value of y.

$y = 3x - 80$

$2y = 6x - 160$, $\quad 2y = 225 - x$

$6x - 160 = 225 - x$ [M1]

$7x = 385$

$x = 55$

$y = 3(55) - 80$

$= 85$

Answer (b) $x =$ 55 [A1]

$y =$ 85 [3] [A1]

For Examiner's Use

13 f is directly proportional to the square root of T.
When $f = 8$, $T = 16$.

(a) Find an equation connecting f and T.

$f = k\sqrt{T}$

$8 = k\sqrt{16}$ [M1]

$= 4k$

$k = \frac{8}{4}$

$= 2$

Answer (a) $f = 2\sqrt{T}$ [2] [A1]

(b) Find the value of f when this value of T is halved.

New $T = 16 \times \frac{1}{2} = 8$ [M1]

New $f = 2\sqrt{8}$

≈ 5.6569 (to 4 d.p.)

Answer (b) 5.6569 (to 4 d.p.) [2]
or 5.66 (to 3 s.f.)

14 50 workers took 6 hours to clean up the National Stadium after the National Day Parade.

How many more workers are needed if they need to clean up the stadium in 4 hours?

Workers	Hours
50	6
↓ ×6	↓ ÷6
300	1
↓ ÷4	↓ ×4
75	4

[M1]

$75 - 50 = 25$

Answer 25 [2] [A1]

For Examiner's Use

15 ξ = { integers x : $0 \le x < 10$ } = {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}
A = { prime numbers } = {2, 3, 5, 7}
B = { multiples of 3 }
= {3, 6, 9}

(a) List all the elements in $A \cap B$.

Answer (a) 3 [1] [B1]

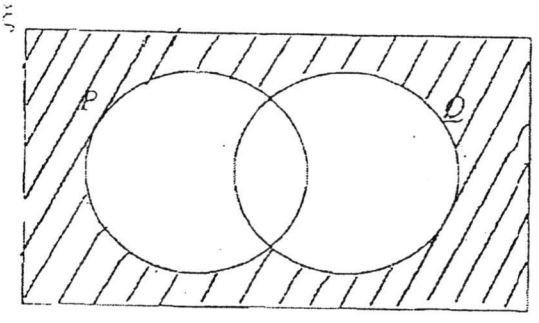
(b) Find $n(A \cup B)$. $A' = \{0, 1, 4, 6, 8, 9\}$

$A' \cup B = \{0, 1, 3, 4, 6, 8, 9\}$

Answer (b) 7 [1] [B1]

---

16 On the Venn diagram, shade the region which represents $(P \cup Q)'$.



[B1]

[1]

---

17 A class of 14 girls and 26 boys took a quiz.
The mean mark for the girls was 27.
The mean mark for the boys was 26.5.

Find the mean mark for the whole class.

$$\text{mean} = \frac{27 \times 14 + 26 \times 26.5}{14 + 26} \quad [M1]$$

$$= \frac{1067}{40}$$

Answer 26.675 [2] [A1]

≈ 26.7 [A0] or $26\frac{27}{40}$

For Examiner's Use

18 One solution of the equation $x^2 + bx - 6 = 0$, where b is a constant, is $x = -2$.

(a) Find the value of b. $(-2)^2 + b(-2) - 6 = 0$

$-2b - 2 = 0$

$-2 = 2b$

$b = -1$

Answer (a) $b =$ -1 [1] [B1]

(b) Hence, find the second solution of the equation.

$x^2 - x - 6 = 0$

$(x + 2)(x - 3) = 0$

$x - 3 = 0$

Answer (b) $x =$ 3 [1] [B1]

19 The table below summarises the number of watches that a group of students have.

Number of watches	0	1	2	3
Frequency	2	7	x	5

(a) Write down the largest possible value of x if the mode is 1.

Answer (a) $x =$ 6 [1] [B1]

(b) Write down the value of x if the median is 1.5.

Answer (b) $x =$ 4 [1] [B1]