15

Geylang Methodist School (Secondary)
Mid-Year Examination 2016

Candidate Name

Class | Index Number

MATHEMATICS

2 Express

Paper 1

Candidates answer on the Question Paper. 1 hour

Setter : Mr Cheng Xin Jin and Mr Benedict Auw 10 May 2016

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class 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.
Calculators 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 3 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 50.

For Examiner's Use
50

This document consists of 7 printed pages including the cover page and 1 blank page.

[Turn over

Total Score: **[50 marks]**
Answer **ALL** questions in this paper.

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1 Written as a product of prime factors, $54 = 2 \times 3^3$.

(a) Write 60 as a product of prime factors in index notation.

(b) Find the highest common factor and lowest common multiple of 54 and 60.

(c) Find the smallest positive integer k such that $60k$ is a perfect square.

Answer: *(a)* _____ [2]

(b) HCF = _____ [1]

LCM = _____ [1]

(c) _____ [1]

2 Given that t is directly proportional to the cube root of s, and $t = 20$ when $s = 64$, find

(a) an equation connecting t and s,

(b) the value of t when $s = 125$,

(c) the value of s when $t = 15$.

Answer: *(a)* _____ [2]

(b) _____ [2]

(c) _____ [1]

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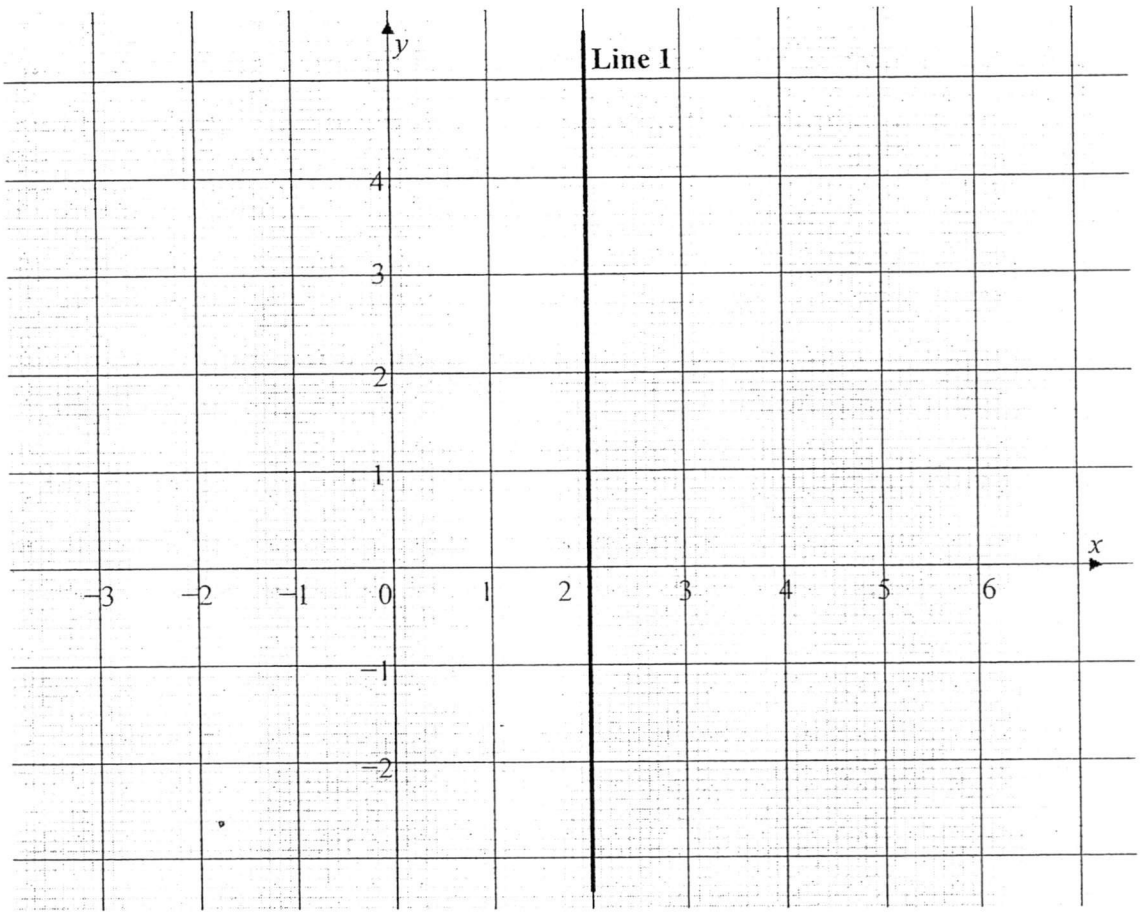
3 Solve the simultaneous equations

$$5x - y = 5,$$
$$3x + 2y = 29.$$

Answer: $x =$ _____

$y =$ _____ [3]

4 The graph below shows line 1.



(a) State the equation of line 1.

(b) Draw and label the equation $y = 3$ on the graph above. [2]

(c) Draw and label the equation $x + 2y = 6$ on the graph above. [3]

Answer: *(a)* _____ [1]

(b) On graph

(c) On graph

5 Expand and simplify the following expressions.

(a) $2a(3a-5)-a(2-a)$,

(b) $4b^2-(3b-4)(2b+1)$.

Answer: *(a)* _____ [3]

(b) _____ [3]

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6 **(a)** It is given that $x-y=2$, and $x^2-y^2=81$, find the value of $4(x+y)^2$.

(b) Without using a calculator, **use special product rules of algebraic expressions** to evaluate $\frac{121}{121^2-125\times117}$.

Answer: *(a)* _____ [3]

(b) _____ [3]

7 Factorise completely

(a) $4x^2 - 8xy$,

(b) $y^2 - 12y - 45$.

Answer: *(a)* _____ [2]

(b) _____ [3]

---

8 Factorise completely the following **using special product rules of algebraic expressions**.

(a) $25a^2 + 5ab + \frac{1}{4}b^2$,

(b) $64 - (c - 1)^2$.

Answer: *(a)* _____ [2]

(b) _____ [3]

9 Simplify the following algebraic expressions.

(a) $\frac{3ab^3}{9a^4b^2}$,

(b) $\frac{c^2-4c}{4c-16}$.

Answer: *(a)* _____ [2]

(b) _____ [2]

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10 Simplify as a single fraction,

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

(b) $\frac{5y}{y^2-1} + \frac{4y}{y+1}$.

Answer: *(a)* _____ [3]

(b) _____ [2]

End of Paper

Answers

1	**(a)**	$60 = 2^2 \times 3 \times 5$. M1 for working, B1 for answer.
	(b)	HCF = 6 . B1 LCM = 540 . B1
	(c)	$k = 15$. B1

2 **(a)** $t = k\sqrt[3]{s}$

$20 = k\sqrt[3]{64}$

$k = \frac{20}{\sqrt[3]{64}}$

$= \frac{20}{4}$

$= 5$ B1

$t = 5\sqrt[3]{s}$. B1

(b) $t = 5\sqrt[3]{125}$ M1

$= 5 \times 5$

$= 25$. B1

(c) $15 = 5\sqrt[3]{s}$

$\sqrt[3]{s} = \frac{15}{5}$

$= 3$

$s = 3^3$

$= 27$. B1

3 $5x - y = 5$

$3x + 2y = 29$

$10x - 2y = 10$

M1

$13x = 39$

$x = 3$. B1

$y = 5x - 5$

$= 5(3) - 5$

$= 15 - 5$

$= 10$. B1

4 **(a)** $x = 2$. B1

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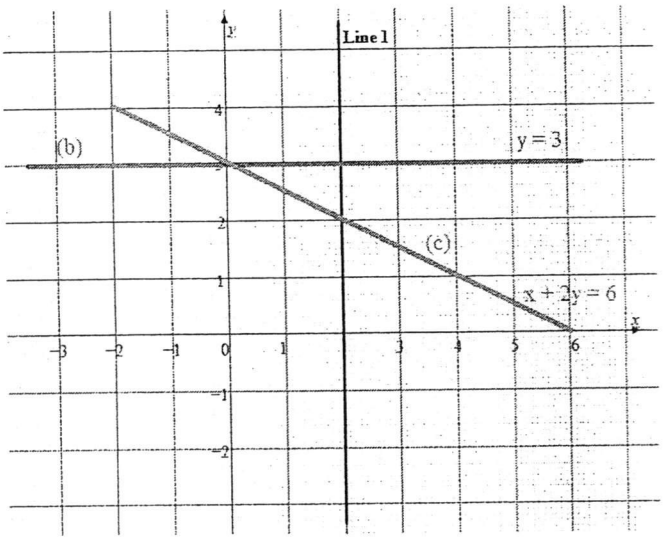
(b)
(c)



For part (b), 1M for line, 1M for label of equation.

For part (c),
1M for straight line passing through at least 1 correct coordinate.
2M for the correct straight line, covering at least half the scale of given x-axis (at least 3 rows of squares).

1M for label of equation.

5 **(a)** $2a(3a-5)-a(2-a)$
$= \underbrace{6a^2-10a}_{B1}\underbrace{-2a+a^2}_{B1}$
$= 7a^2-12a$. B1

(b) $4b^2-(3b-4)(2b+1)$
$= 4b^2-(6b^2+3b-8b-4)$ M1
$= 4b^2-6b^2-3b+8b+4$ M1
$= -2b^2+5b+4$. B1

6 **(a)** (x+y)(x-y) = 81 (M1)
x+y = 40.5 (M1)
$4(x+y)^2 = 6561$ (A1)

(b) $\frac{121}{121^2-125\times117} = \frac{121}{121^2-(121^2-4^2)}$ (M1), (M1)
$= \frac{121}{16} = 7\frac{9}{16}$ (A1)

1 mark for special identities.
1 mark for opening brackets.

7 **(a)** $4x^2-8xy$
$= \underbrace{4x}_{B1}\underbrace{(x-2y)}_{B1}$.

(b) $y^2-12y-45$
= cross method M1
$= \underbrace{(y-15)}_{B1}\underbrace{(y+3)}_{B1}$.

8 **(a)** $25a^2+5ab+\frac{1}{4}b^2$
$= (5a)^2+2(5a)\left(\frac{1}{2}b\right)+\left(\frac{1}{2}b\right)^2$ M1
$= \left(5a+\frac{b}{2}\right)^2$. B1

1. No marks if cross method is used directly.

2. Answer mark given if attempt to use special Identity is shown.

(b) $64-(c-1)^2$

$=8^2-(c-1)^2$

$=\underbrace{(8+c-1)}_{M1}\underbrace{\big(8-(c-1)\big)}_{M1}$

$=(7+c)(9-c)$. B1

9 **(a)** $\frac{3ab^3}{9a^4b^2}=\frac{ab^3}{3a^4b^2}$ B1

$=\frac{b}{3a^3}$. B1

(b) $\frac{c^2-4c}{4c-16}=\frac{c(c-4)}{4(c-4)}$ M1

$=\frac{c}{4}$. B1

10 **(a)** $\frac{2}{x+1}-\frac{3}{2x-5}=\frac{2(2x-5)-3(x+1)}{(x+1)(2x-5)}$ M1

$=\frac{4x-10-3x-3}{(x+1)(2x-5)}$ M1

$=\frac{x-13}{(x+1)(2x-5)}$. B1

(b) $\frac{5y}{y^2-1}+\frac{4y}{y+1}=\frac{5y}{y^2-1}+\frac{4y(y-1)}{(y+1)(y-1)}$ M1

$=\frac{5y+4y^2-4y}{y^2-1}$

$=\frac{4y^2+y}{y^2-1}$. B1

Geylang Methodist School (Secondary)
Mid-Year Examination 2016

MATHEMATICS

Paper 2 — **2 Express**

Additional materials :Writing Paper
Graph Paper — **1 hour 30 minutes**

Setter : Ms Grace Yap and Mr Benedict Auw — **11 May 2016**

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen on both sides of the 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 with the answer.
Omission of essential working will result in loss of marks.
Calculators 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 3 significant figures. Give answers in degrees to one decimal place.

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 number of marks for this paper is 50.

Total Score: **[50 marks]**
Answer **ALL** questions in this paper.

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1 In a particular month, a second hand car dealer bought a sports car at \$68 000 and a sedan car at \$32 000. Due to the poor condition of the car, the car dealer spent another \$1500 on repairing the sports car.

(a) The dealer later sold the sports car at a loss of 5% of the total amount spent on the car. Find the selling price of the sports car. [2]

(b) The car dealer sold the sedan car at a profit of 15%. Find the selling price of the sedan car. [1]

(c) Find the total amount of profit or loss from these two transactions. [2]

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2 Expand and simplify the following.

(a) $(a-3b)(3a+b)$, [2]

(b) $3x(2x-y)-2(x-3y)(3x-y)$. [4]

---

3 Factorise completely

(a) $3x^2+6xy-4xz-8yz$, [3]

(b) $x^2(m-n)+4(n-m)$. [3]

---

4 Simplify the following.

(a) $\dfrac{x+1}{-4x^2-3x+1} \times \dfrac{1-16x^2}{2x-1}$, [3]

(b) $\dfrac{r-s}{4s+36r} \div \dfrac{s-r}{18r+2s}$. [3]

5 The table below shows some values of x and the corresponding values of $y-1$.

x	2	3	4	6
$y-1$	1008	672	504	336

(a) Show that x and $(y-1)$ are in inverse proportion. [1]

(b) Express y in terms of x. [2]

(c) Find the value of y when $x = 7$. [1]

(d) Describe how the value of $(y-1)$ changes when x is doubled. [1]

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6 The giant pandas Kai Kai and Jia Jia reside at the River Safari. The sum of their ages when they first arrived in Singapore in 2013 was 11 years.
In 2022, Kai Kai will be three times as old as Jia Jia was in 2013.

Find Kai Kai's age in 2016. [4]

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7 Given that $\frac{1}{a+b}+\frac{1}{a-b}=\frac{2}{c}$, find c in terms of a and b, leaving your answer as a fraction in its simplest form. [4]

---

8 Map A has a scale of $1 : n$, where n is a whole number.
A lake of area 1 km^2 isrepresented by an area of 4 cm^2 on this map.

(a) Evaluate the value of n. [2]

A new map has to be drawn for the same area, such that the area of the lake on theoriginal map$A$ is 9 times bigger than the area represented on the new map.

(b) **(i)** Represent the scale of the new map in the form of $\frac{1}{r}$. [2]

(ii) Calculate the distance, in km, represented by 16 cm on the new map. [1]

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

The table below shows the values of x and the corresponding values of y, where $2x - y = -3$.

x	-3	-2	-1	0	1	2
y	-3	a	1	b	5	7

(a) Find the value of a and of b. [2]

(b) Using a scale of 4 cm to represent 1 unit on the x-axis and 2 cm to represent 1 unit on the y-axis, draw the graph of $2x - y = -3$ for $-3 \leq x \leq 2$. [3]

(c) On the same diagram, draw the graph $y = -x$ for $-3 \leq x \leq 2$. [2]

(d) Hence, solve the following simultaneous equations graphically.

$$2x - y = -3 \ ,$$
$$x + y = 0 \ .$$ [2]

End of Paper

Answers

1 (a) Total cost for sports car = \$(68000 + 1500)

= \$69500 ----------(1m)

$$\text{Selling price} = \frac{95}{100} \times \$69500$$

= \$66025 ----------(1m)

(b) $$\text{Selling price of sedan car} = \frac{115}{100} \times 32000$$

= \$36800 ----------(1m)

(c) Total cost of sports car and sedan = \$(68000 + 32000 + 1500)

= \$101500

Amount made selling sports car and sedan

= \$(66025 + 36800)

= \$102825 } 1M

Amount profited = \$(102825 − 101500)

= \$1325 ----------(1m)

2 (a) $(a - 3b)(3a + b) = 3a^2 + ab - 9ab - 3b^2$ M1

$= 3a^2 - 8ab - 3b^2$. B1

(b) $3x(2x - y) - 2(x - 3y)(3x - y)$

$= \underbrace{6x^2 - 3xy}_{B1} - 2\underbrace{(3x^2 - xy - 9xy + 3y^2)}_{M1}$

$= 6x^2 - 3xy - 6x^2 + 2xy + 18xy - 6y^2$ M1

$= -6y^2 + 17xy$. B1

3 (a) $3x^2 + 6xy - 4xz - 8yz$

$= \underbrace{3x(x + 2y)}_{B1}\underbrace{-4z(x + 2y)}_{B1}$

$= (3x - 4z)(x + 2y)$. B1

(b) $x^2(m - n) + 4(n - m)$

$= x^2(m - n) - 4(m - n)$ M1

$= (x^2 - 4)(m - n)$ B1

$= (x + 2)(x - 2)(m - n)$. B1

4 (a) $$\frac{x+1}{-4x^2-3x+1} \times \frac{1-16x^2}{2x-1}$$

$$= \frac{x+1}{(x+1)(-4x+1)} \times \frac{(1+4x)(1-4x)}{2x-1}$$ ----------(2m)

$= \dfrac{1+4x}{2x-1}$ ----------(1m)

(b) $\dfrac{r-s}{4s+36r} \div \dfrac{s-r}{18r+2s}$

$= \dfrac{-(s-r)}{4(s+9r)} \div \dfrac{s-r}{2(9r+s)}$ ----------(1m)

$= \dfrac{-(s-r)}{4(s+9r)} \times \dfrac{2(9r+s)}{s-r}$ ----------(1m)

$= -\dfrac{1}{2}$ ----------(1m)

5 (a) $2 \times 1008 = 2016$

$3 \times 672 = 2016$

$4 \times 504 = 2016$

$6 \times 336 = 2016$

Any two of the above. ---------- (1m)

(b) $x(y-1) = 2016$ ---------- (1m)

$xy - x = 2016$

$xy = 2016 + x$

$y = \frac{2016+x}{x}$. ---------- (1m)

(c) $y = \frac{2016+7}{7}$

$= 289$. ---------- (1m)

(d) The value of $y - 1$ is halved. ---------- (1m)

6 Let Kai Kai's age in 2013 be x.

Let Jia Jia's age in 2013 by y.

$x + y = 11$]

$x + 9 = 3y$] M1

$x - 3y = -9$

$4y = 11 + 9$ M1 to eliminate x

$y = 5$

$x = 6$ B1 for Kai Kai's age

Kai Kai's age in 2016 = 6 + 3

= 9 . B1

7 $\frac{1}{a+b}+\frac{1}{a-b}=\frac{2}{c}$

$\frac{a-b+a+b}{a^2-b^2}=\frac{2}{c}$ ----------(2m)

$\frac{2a}{a^2-b^2}=\frac{2}{c}$

$2ac=2a^2-2b^2$ ----------(1m)

$c=\frac{2a^2-2b^2}{2a}$

$c=\frac{a^2-b^2}{a}$ ----------(1m)

8 (a)

Map	Actual
4 cm^2	1 km^2
1 cm^2	$\frac{1}{4}$ km^2----------(1m)
1 cm	$\frac{1}{2}$ km

$\frac{1}{2}$ km = 50000 cm

n = 50000 ----------(1m)

(b) (i)

New map	Actual
$\frac{4}{9}$ cm^2	1km^2
$\frac{2}{3}$ cm	1 km ----------(1m)
1 cm	$\frac{3}{2}$ km

$\frac{3}{2}$ km = 150000

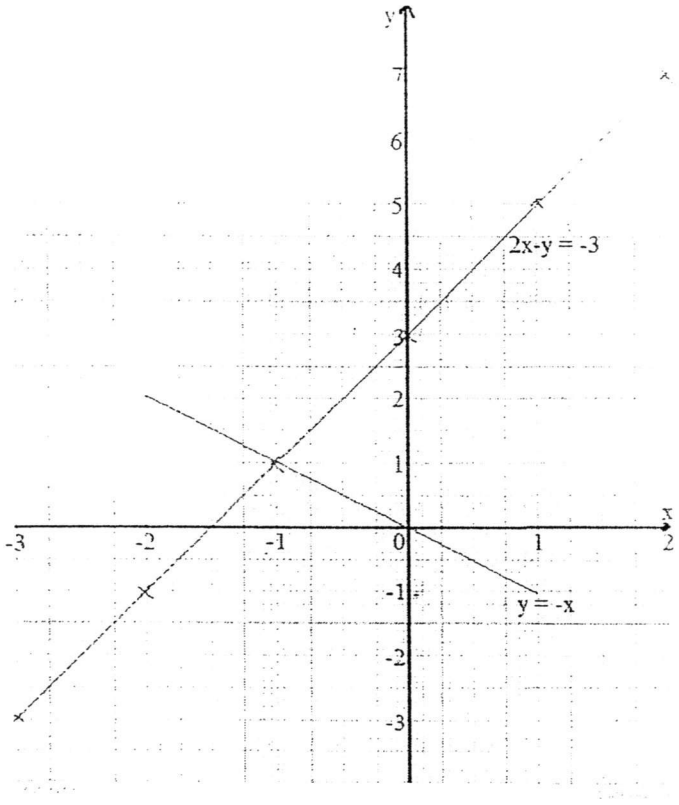
$\frac{1}{r}=\frac{1}{150000}$ ----------(1m)

(ii) Dist = $(16\times\frac{3}{2})$ km

= 24 km ----------(1m)

9 **(a)** $a = -1$. B1
$b = 3$. B1

(b)
(c)



For 3M of (b), round down marks obtain after $-\frac{1}{2}$ M for every missing/incorrect:

-label of both axes.
-scale on both axes.
-plotting of at least 2 points with crosses
-clean straight line to cover the given interval
-label equation of line.

For 2M of (c), 1 mark for line, 1 mark for label of line.

(d) $x = -1$ B1
$y = 1$. B1