L4

Class	Register Number	Name

南洋女子中学校

NANYANG GIRLS' HIGH SCHOOL

End of Year Examination 2016
Secondary Two

INTEGRATED MATHEMATICS PAPER 1 — **1 hour 30 min**

Friday — **7 October 2016** — **0845 – 1015**

READ THESE INSTRUCTIONS FIRST

INSTRUCTIONS TO CANDIDATES

1. Answer **all** the questions.
2. Write your answers and working on the separate answer paper provided.
3. Write your name, register number and class on each separate sheet of paper that you use and fasten the separate sheets together with the string provided.
4. Write in dark blue or black pen on both sides of the paper.
5. You may use an HB pencil for any diagrams or graphs.
6. Do not use staples, paper clips, glue or correction fluid.
7. Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION FOR CANDIDATES

1. The number of marks is given in brackets [ ] at the end of each question or part question.
2. The total number of marks for this paper is 60.
3. The use of an approved scientific calculator is expected, where appropriate.
4. You are reminded of the need for clear presentation in your answers.

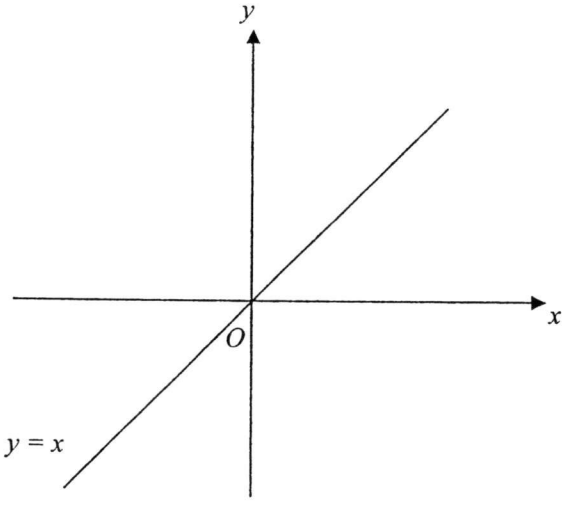
1. Given that $\frac{3x-4y}{2x+3y}=\frac{2}{3}$, find the value of $\frac{x}{y}$. [2]

2. The graph of $y=x$ is shown below. Copy the diagram below to your answer script and sketch the graphs of the following given equations. For each case, indicate the intercepts with the axes clearly. Label each graph clearly with its equation.

(a) $x=6$, [1]

(b) $y=-2x+3$, [2]

(c) $y=kx-c$, where $0<k<1$, $0<c<3$. [2]

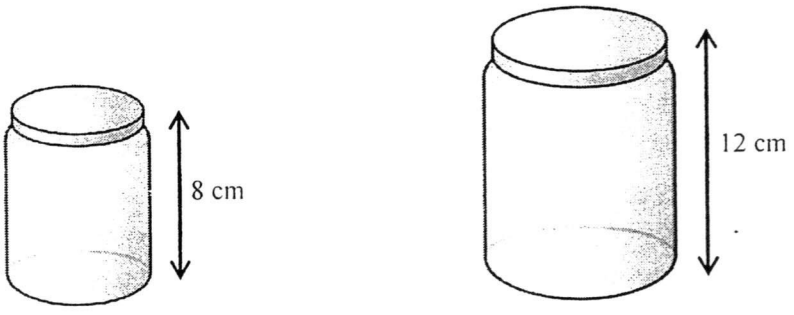


3. The line k is parallel to the line $2x+3y=6$ and passes through the point $(3, 5)$.

(a) Find the equation of line k. [3]

(b) State the equation of another line l which has an infinite number of solutions with line k. [1]

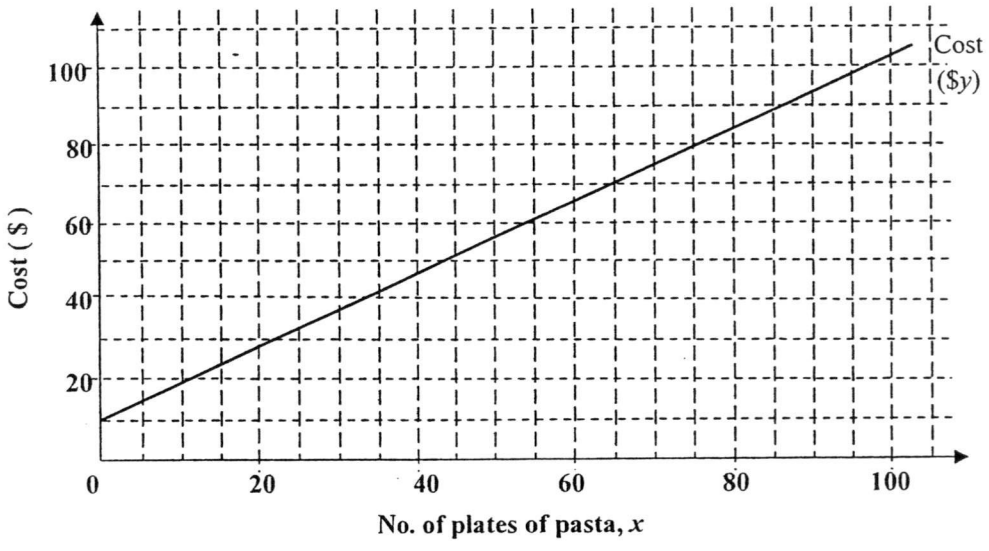
4. A supermarket sells jam in jars of two sizes as shown below. The two jars are geometrically similar. The heights of the two jars are 8 cm and 12 cm respectively.



(a) Given that the base area of the smaller jar is 42 cm^2, find the base area of the larger jar. [2]

(b) Given that the cost of the larger jar of jam is \$5, calculate the cost of the smaller jar of jam. [2]

5. The graph below shows the cost of selling plates of pasta in a food stall:



The graph is represented by $y = Ax + B$, where \$$y$ represents the cost of selling plates of pasta in the food stall and x represents the number of plates of pasta.

(a) State the cost of selling 65 plates of pasta. [1]

(b) State the value of B and explain its significance. [2]

(c) Calculate the value of A and explain its significance. [2]

6. Solve the following equations:

(a) $(2x-1)(x+3)=14$. [3]

(b) $\dfrac{3}{2-x}+\dfrac{4}{x-2}+\dfrac{1}{3}=0$, [3]

(c) $\dfrac{20}{3x^2-13x-10}+\dfrac{12}{3x+2}=\dfrac{x}{7x-35}$. [5]

7. Solve the following pair of simultaneous equations:

$$2x^2-4xy+2y^2=5x-0.5y$$

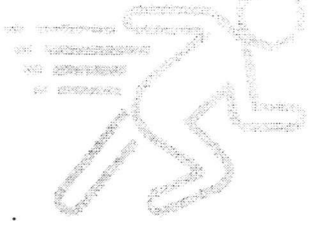
$$y-2x=0$$ [5]

8. Student A completes a distance run of 2.4 km at a usual average speed of x km/h.

(a) On Monday, her average speed was y km/h slower than usual and she completed the run in 15 minutes. Form an equation in x and y and show that it reduces to $x-y=9\dfrac{3}{5}$. [2]

(b) On Tuesday, her average speed was $\dfrac{1}{3}y$ km/h faster than usual. She completed the run in $11\dfrac{1}{4}$ minutes. Form an equation in x and y and show that it reduces to $15x+5y=192$. [2]

(c) Solve these two equations in x and y. Hence, find the usual time taken, in minutes, for Student A to complete her 2.4 km run. [3]



9. **(a)** It is given that $-2x-\frac{1}{3}<\frac{3x-2}{4}\leq 7$.

(i) Solve the inequality and represent the solution on a number line. [4]

(ii) Hence, state the smallest integer value of x. [1]

(b) Given that $3\leq a\leq 5$ and $-2\leq b\leq 4$ and that a and b are integers, find

(i) the smallest possible value of ab, [1]

(ii) the smallest possible value of a^2+b^2, [1]

(iii) the biggest possible value of $a-\frac{b}{a}$. [2]

10. $ACEG$ is a parallelogram with AC parallel to GE. AG, BF and CE are parallel lines. H is the mid-point of AG and D is the mid-point of CE. B is the mid-point of AC and F is the mid-point of GE. HF is parallel to BD. GD intersects HF at J and BF at K. $HJ : JF = 2 : 1$, $HF : FB = 3 : 4$ and $FK : KB = 1 : 3$.

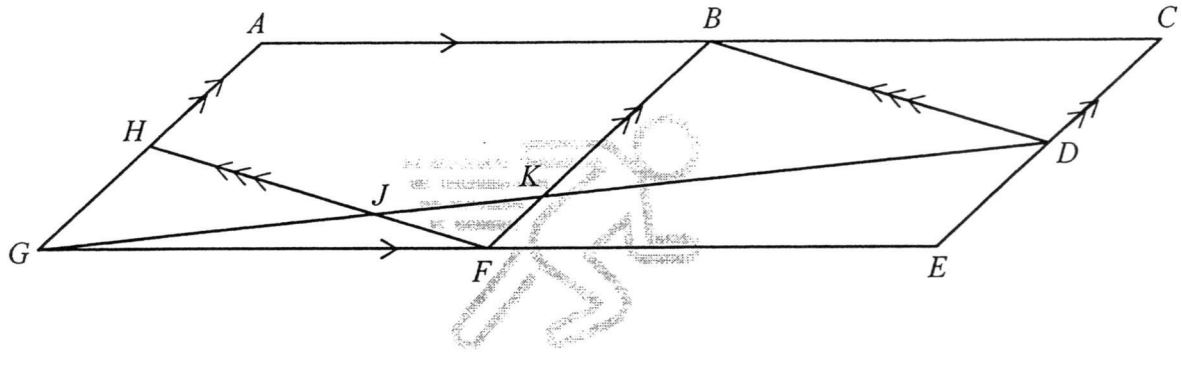
(a) Name 1 pair of congruent triangles. [1]

(b) Prove that ΔHJG is similar to ΔFJK, stating the geometrical reasons and the case of similarity clearly. [3]

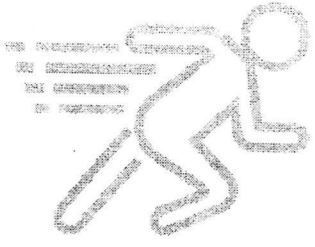
(c) Name another pair of similar triangles. [1]

(d) Given that $HJ = 6$ cm, find the length of KB. [1]

(e) Given that the area of ΔJKF is 2.4 cm^2, find the area of ΔGJF. [2]



END OF PAPER



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End of Year Examination 2016
Secondary Two

INTEGRATED MATHEMATICS PAPER 2 **1 hour 30 min**

Friday **7 October 2016** **11 15 – 12 45**

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1 Make b the subject of each of the following formulae, expressing your answer in the simplest form.

(a) $\sqrt[3]{a-b} = (1-4c)^3$ [2]

(b) $\frac{1}{a} + \frac{1}{2b} = \frac{1}{3c} + \frac{1}{4}$ [3]

2 Simplify the following, leaving your answer as a single fraction.

(a) $\frac{1}{g^2-6g} + \frac{3}{2g^2-10g-12}$ [3]

(b) $\frac{p-r-q}{p+r-q} \times \frac{(p+r)^2-q^2}{p^2-q^2-r^2-2qr}$ [3]

3 **(a)** Simplify $\frac{(-2a^2)^{-3}n^4}{24} \times \frac{a^0}{n^5b^{-2}} \div \frac{8a}{36b^2}$, leaving your answer in positive indices. [4]

(b) Solve $8^{x-1} - 4\left(\frac{1}{2}\right)^x = 0$. [3]

4 **(a)** Without use of calculator, express the following in standard form.

(i) $13\times10^{576}\times7\times10^{-156}$ [2]

(ii) $78\times10^{170}+6\times10^{171}$ [2]

(b) The estimated population of Singapore was 4.401×10^6 in 2003 and five million, three hundred and ninety thousand in 2013.

(i) Write the population of Singapore in 2013 in standard form. [1]

(ii) Find the percentage increase in population from 2003 to 2013. [2]

(iii) The total land area of Singapore was estimated to be (7.05×10^2) km^2 in 2013. In that year, a city would be ranked among the Top 30 most overpopulated cities if its population density exceeded 7.8×10^3 people per square kilometre. Determine if Singapore was among the Top 30 most overpopulated cities in 2013. [3]

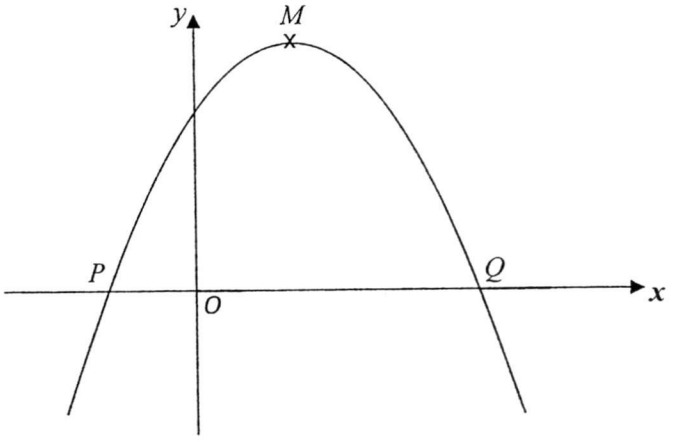
5 Solve $3x^2 - 8x + 2 = 0$ by completing the square.

Hence, solve $\frac{3}{y^2} + \frac{8}{y} + 2 = 0$. [5]

6 A quadratic curve cuts the x-axis at P and Q. The coordinates of Q are (4, 0) while the x-coordinate of the maximum point M is 1.25.

(i) Find the coordinates of P. [2]

(ii) Find the equation of the curve given that the y-intercept is 24. [3]



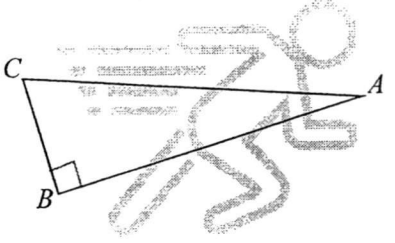
7 At a National Day Parade rehearsal, it is noted that quadratic function that describes a particular firework shell's parabolic path is $h = -8t^2 + 40t + 2$ where h is the height above ground in metres and t is the time in seconds after it is launched.

(i) Find the values of t when $h = 2$. [2]

(ii) Given that this firework shell explodes at the greatest possible height, how long will it take for it to explode after it is launched? [2]

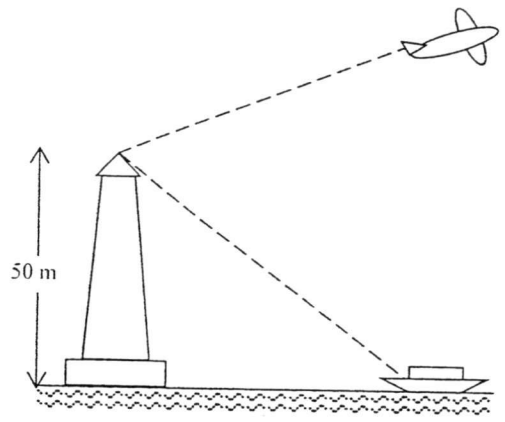
(iii) How high will the firework shell reach at the moment of explosion? [1]

8 **(a)** In the right-angled triangle, $\sin C = \frac{24}{25}$. Without the use of calculators, find the <u>exact</u> value of $\frac{3}{\cos C} - \tan(90° - C)$.



[4]

8 (b)



From the top of a lighthouse 50 m high, a lighthouse keeper sighted an airplane and a ship directly beneath the plane. In sighting the ship, the angle of depression was 28°.

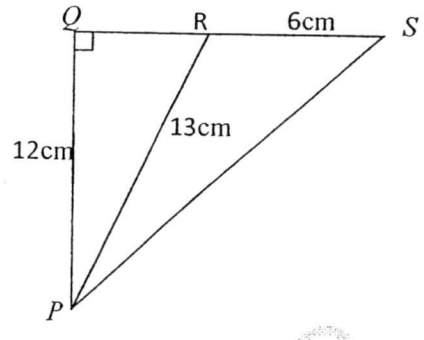
(i) Find the distance d, of the boat from the foot of the lighthouse. [2]

(ii) The airplane is 85 m above sea-level. Find the angle of elevation of the airplane from the top of the lighthouse. [2]

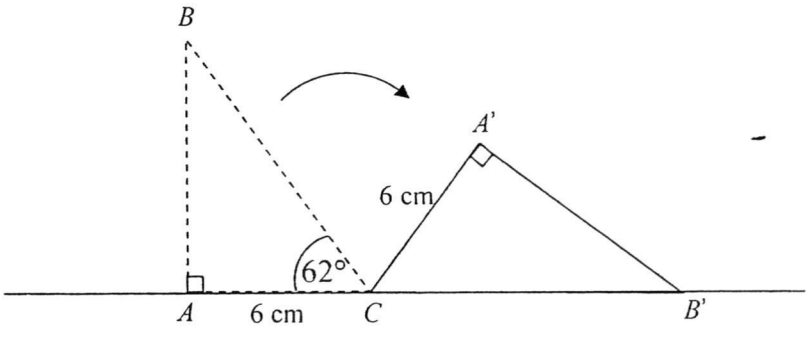
9 **(a)** In ΔPQS, $\angle PQS = 90°$, $PQ = 12\text{cm}$, $RS = 6\text{cm}$ and $PR = 13\text{cm}$.

(i) Calculate the area of ΔPQS. [2]

(ii) Hence, find the shortest distance from Q to PS. [3]



9 (b)



The latest gadget sold in a furniture store is a dual function bookend ABC (side view), where $\angle BAC = 90°$, $\angle BCA = 62°$ and $AC = 6$ cm.

The bookend initially stood with AC on a horizontal surface.

When rotated about the point C onto $A'B'C$, where ACB' is a straight line, it functions as a door stopper $A'B'C$. Calculate, leaving your answer to 2 decimal places where necessary,

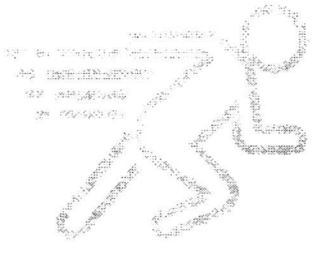
(i) $\angle BCA'$, [1]

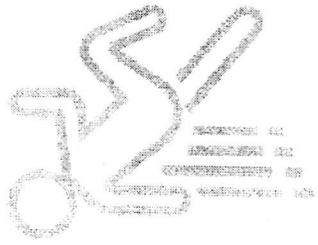
(ii) the maximum gap between the base of a door and the floor in order that the gadget can serve as a door stopper. [3]

Bonus Question

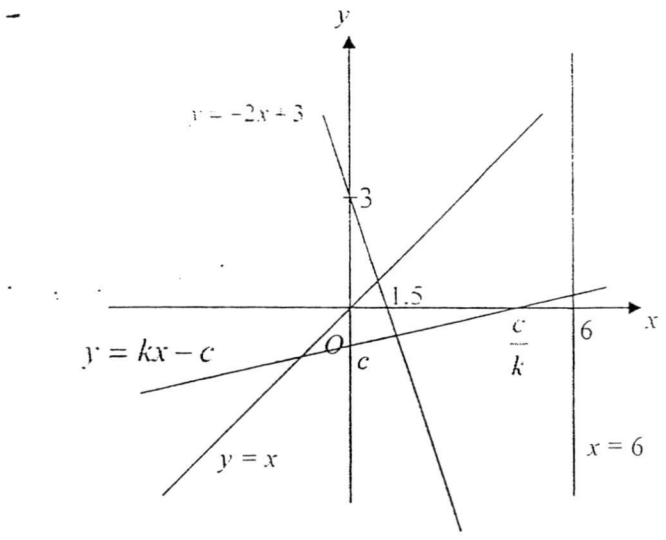
10 Four isosceles right angled triangles are removed from four corners of a square piece of paper so that a rectangle remains. What is the length of a diagonal of the remaining rectangle if the sum of the areas of the cut-off pieces is $50\,\text{cm}^2$? [3]

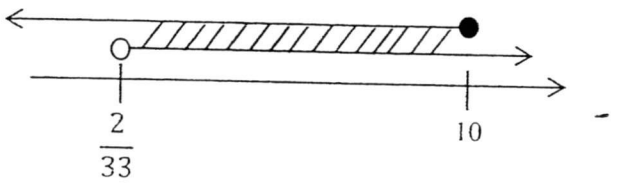
End of Paper





Sec 2 2016 EOY P1 Ans Key

No.	Solution
1	$\frac{x}{y}=\frac{18}{5}$
2	
3a	$y=-\frac{2}{3}x+7$
3b	$4x+6y=12$ or its equivalent
4a	Base area of larger jar = 94.5 cm^2
4b	Cost = \$1.48
5a	\$70
5b	\$10. It is the startup/basic cost of selling the pasta.
5c	For every additional plate of pasta sold, the extra cost incurred is \$0.92. (± 0.1).
6a	$x=1.92 \quad or \quad -4.42\ (3\ sf)$
6b	$x=-1$
6c	$x=\frac{70}{3}=23\frac{1}{3}$ or 4
7	*when* $x=0,\ y=0$ *when* $x=2,\ y=4$
8a	$x-y=9\frac{3}{5}$
8b	$15x+5y=192$
8c	$x=12$ Time taken = 12 min

9ai	$\therefore \frac{2}{33} < x \leq 10$ 
9aii	1
9bi	the smallest possible value of ab $ab = -10$
9bii	smallest possible value of $a^2 + b^2$ $a^2 + b^2 = 9$
9biii	biggest possible value of $a - \frac{b}{a}$ $a - \frac{b}{a} = 5\frac{2}{5}$
10a	$\Delta HFG \equiv \Delta DBC$.
10b	$\angle HJG = \angle FJK$ (vert opp $\angle$) $\angle GHJ = \angle KFJ$ (alt $\angle$, $GH \parallel FK$) $\therefore \Delta HJG$ is similar to ΔFJK as their corresponding angles are equal.
10c	ΔHJG and ΔFJK or ΔHJG and ΔBDK *or* ΔKGF and ΔDGE
10d	$KB = 9$ cm
10e	Area of $\Delta GJF = 4.8\,\text{cm}^2$

Sec 2 Math EOY 2016 Paper 2 Answer Key

1(a)	$b = a - (1-4c)^9$
1(b)	$b = \dfrac{6ac}{4a+3ac-12c}$
2a	$\dfrac{5g+2}{2g(g-6)(g+1)}$
2b	1
3a	$-\dfrac{3b^4}{128na^7}$
3b	$x = 1\dfrac{1}{4}$
4(a)i	9.1×10^{421}
4(a)ii	1.38×10^{172}
4(b)i	5.39×10^6
4(b)ii	22.5%
4(b)iii	$7.645\times10^3 < 7.8\times10^3$ Hence, Singapore was not among the Top 30 most overpopulated cities.
5	$x = 2.39$ or $0.279 (3sf)$ $y = -0.419$ or -3.58
6(i)	Coordinates of $\boldsymbol{P}$ = (-1.5, 0)
6(ii)	$y = -4x^2 + 10x + 24$
7(i)	$t = 0$ or 5
7(ii)	$t = 2.5$
7(iii)	52 m above ground
8(a)	$10\dfrac{71}{168}$
8b(i)	94.0 m
8b(ii)	Angle of elevation = 20.4°
9(a)i	66 cm^2
9(a)ii	8.11 cm (2 dp)
9(b)i	56°
9(b)ii	The maximum gap allowed is 5.29cm
10	10 cm