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Class	Full Name	Index Number

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END OF YEAR EXAMINATION 2016

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4048 /02

MATHEMATICS
Paper 2

Secondary 2 Express
10th October 2016

1 hour 15 min

Additional Materials: Writing Papers
Graph Paper (1 sheet)

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number in the spaces provided.
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.

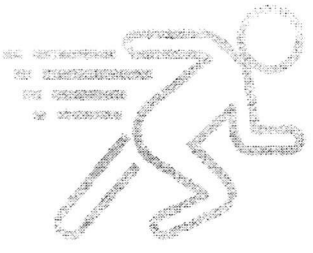
Answer **all** questions.
If working is needed for any question, it must be shown with the answer.
Omission of essential working will result in loss of marks.
Calculators should be used where appropriate.
If the degree of accuracy is not specified in the question and if the answer is not exact, give the answer to 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.

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 of the marks for this paper is 50.

DO NOT OPEN THIS PAPER UNTIL YOU ARE TOLD TO DO SO

For Examiner's Use
50

This document consists of 6 printed pages, including this cover page.

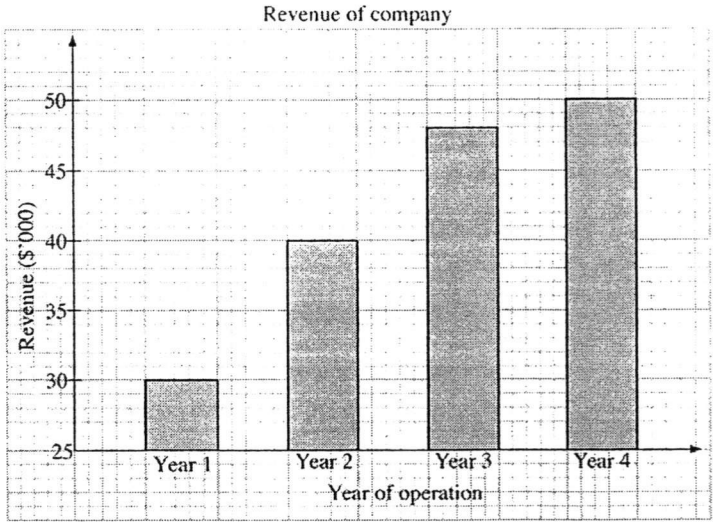


ANSWER ALL QUESTIONS

1 **(a)** Given that $\frac{p}{x} = 21 - 3p$, find the value of x when $p = 4$. [1]

(b) Given that $S = \sqrt{M} + 5\pi$, express M in terms of π and S. [2]

2 The bar chart below shows the revenue of a company in its first four years of operation.



Hazeeq concluded that the company's revenue in Year 2 is three times the revenue earned in Year 1. Do you agree? Justify your answer. [2]

3 The total cost of 7 pencils and 5 pens is \$10.85.

The total cost of 9 pencils and 10 pens is \$18.95.

(a) Let the price of 1 pencil be \$ x and the price of 1 pen be \$ y.

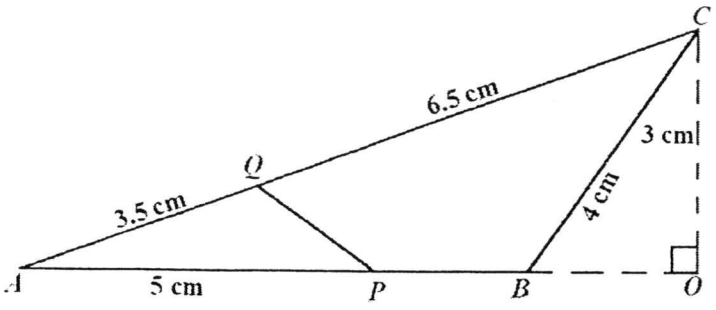
Write down two equations, in terms of x and y. [2]

(b) Solve the simultaneous equations. [3]

(c) Hence, find the total cost of 17 pencils and 23 pens, in dollars. [1]

4 In the figure, ΔAPQ is similar to ΔACB.

$AP = 5$ cm, $BC = 4$ cm, $AQ = 3.5$ cm, $QC = 6.5$ cm and $OC = 3$ cm.



Find

(a) the length of AB, [2]

(b) angle CAB, [2]

(c) shortest distance from B to AC. [2]

5 **(a)** Express $\dfrac{1}{x+2}+\dfrac{3x-2}{3x^2+4x-4}-\dfrac{3}{4-x^2}$ as a single fraction in its **simplest form**. [3]

(b) The force, F, between two particles is inversely proportional to the square of the distance between them. The force is 36 units when the distance between the particles is r metres. Find the force when the distance is $2r$ metres. [2]

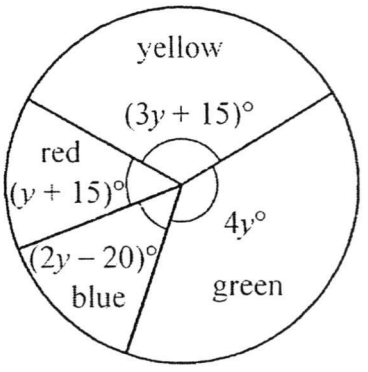
6 Some students were asked how long they spent on the internet every day. The table shows the result.

Number of hours	0	1	2	3	4	5
Number of students	7	6	11	13	7	x

(a) It is given that the mode is 3. Write down the largest possible value of x. [1]

(b) It is given that the median is 3. Write down the smallest possible value of x. [2]

7 The pie chart shows the number of different coloured balls in a bag.



(a) Find the value of y. [2]

(b) Find the probability of choosing a ball, in random, which is neither blue nor yellow. [1]

8 The weekly wages of 100 workers who work in a factory are given in the table below.

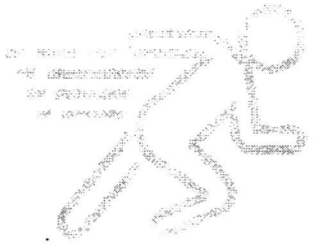
Weekly wage ($x)	$180 < x \leq 220$	$220 < x \leq 260$	$260 < x \leq 300$	$300 < x \leq 340$
Number of workers	15	50	23	k

(a) Find the value of k. [1]

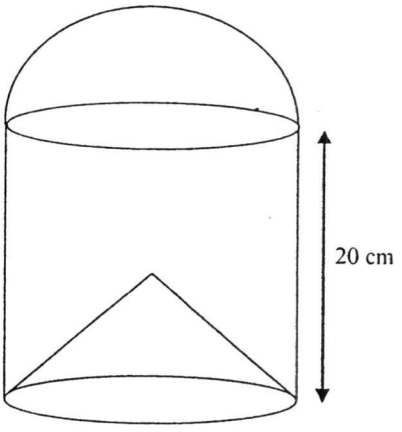
(b) Find, from the distribution of weekly wages, an estimate of the mean wage. [2]

(c) One worker is chosen at random from those who work in the factory.

Expressing your answer as a fraction in its lowest terms, find the probability that the



9 A model consists of a solid hemisphere attached to a solid cylinder. Part of the cylinder in the shape of a cone is removed as shown in the diagram. The height of the cylinder is 20 cm and the area of its base is 201 cm^2.



(a) Find the radius of the cylinder. [2]

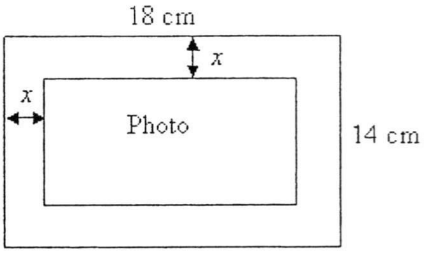
(b) Given that the volume of the cone removed is 662 cm^3, calculate the height of the cone. [2]

(c) Given that the model is made from material of density 0.5g/cm^3, calculate its mass correct to the nearest gram. [3]

(d) Taking the area of the curved surface of the cone to be 251cm^2, calculate the total surface area of the model. Leave your answer correct to two decimal places. [3]

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

10 A photo of area 96 cm^2 is placed on a photo frame of 18 cm by 14 cm with a border of uniform width as shown.



(a) Form an equation in x and show that it reduces to $x^2 - 16x + 39 = 0$. [3]

The area of the photo is represented by $y = x^2 - 16x + 39$.

Some corresponding values of x and y, are given in the table below.

x	0	2	4	6	8	10	12	14
y	39	11	−9	−21	p	−21	−9	11

(b) Calculate the value of p. [1]

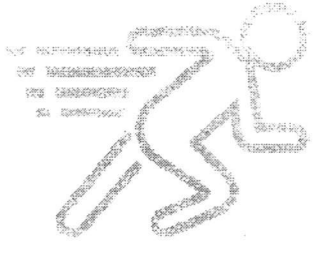
(c) Using a scale of 2 cm to represent 2 units, draw a horizontal x-axis for $2 \le x \le 16$.

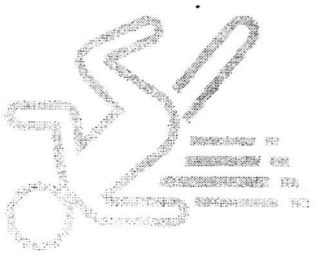
Using a scale of 2 cm to represent 10 units, draw a vertical y-axis for $-30 \le y \le 40$.

On your axes, plot the points given in the table and join them with a smooth curve. [3]

(d) From your graph, find the values of x when $y = 0$. [1]

END OF PAPER





SEC 2 EXPRESS SA2 PAPER 2 (2016) MARKING SCHEME

1)	(a)		$\frac{p}{x} = 21 - 3p$ $\frac{4}{x} = 21 - 3(4)$ $4 = 9p$ $p = \frac{4}{9}$ $---A1$
	(b)		$S = \sqrt{M} + 5\pi$ $S - 5\pi = \sqrt{M}$ $---M1$ $M = (S - 5\pi)^2$ $---A1$
2)			No, I do not agree. -A1 The revenue in year 2 is 4/3 times of the revenue earned in year1.---A1
3)	(a)		The two equations are: $7x + 5y = 10.85$ $---A1$ $9x + 10y = 18.95$ $---A1$
	(b)		$7x + 5y = 10.85$ $---(1)$ *Eqn* (1) × 2, $14x + 10y = 21.70$ $---(2)$ $9x + 10y = 18.95$ $---(3)$ (2) − (3), $5x = 2.75$ $x = 0.55$ $---A1$ *Subst.* $x = 0.55$ into (1), $7(0.55) + 5y = 10.85$ $y = 1.40$ $---A1$ $\therefore x = 0.55, y = 1.40$ (*M1 for any correct part of workings,any method*)
	(c)		*Total* cost $= 17(\$0.55) + 23(\$1.40)$ $= \$41.55$ $---A1$
4)	(a)		$\frac{AB}{AQ} = \frac{AC}{AP}$ $\frac{AB}{3.5} = \frac{6.5 + 3.5}{5}$ $---M1$ $AB = 7\ cm$ $---A1$

	(b)		$\sin \angle CAO = \frac{3}{10}$ $---M1$ $\angle CAO = 17.4576°$ $\therefore \angle CAB = 17.5°$ $---A1$	
	(c)		Let the shortest distance be BX.	
			Method 1 $\frac{1}{2} \times BX \times 10 = \frac{1}{2} \times 7 \times 3$ $---M1$ $BX = 2.1\ cm$ $---A1$ *Method 2* $\sin 17.4576 = \frac{BX}{7}$ $---M1$ $BX = 2.1\ cm$ $---A1$	
5	(a)		$\frac{1}{x+2} + \frac{3x-2}{3x^2+4x-4} - \frac{3}{4-x^2}$ $= \frac{1}{x+2} + \frac{3x-2}{(3x-2)(x+2)} - \frac{3}{(2-x)(2+x)}$ $---M1$ $= \frac{1}{x+2} + \frac{1}{x+2} - \frac{3}{(2-x)(2+x)}$ $= \frac{2}{x+2} - \frac{3}{(2-x)(2+x)}$ $= \frac{2(2-x)-3}{(2-x)(2+x)}$ $---M1$ $= \frac{4-2x-3}{(2-x)(2+x)}$ $= \frac{1-2x}{(2-x)(2+x)}$ $---A1$	
	(b)		$F = \frac{k}{d^2}$, *where k is a constant* $36 = \frac{k}{r^2}$ $k = 36r^2$ $---M1$ *New* $F = \frac{36r^2}{(2r)^2}$ $= \frac{36r^2}{4r^2}$ $= 9$ $---M1$	
6	(a)		Largest possible value of x = 12 --- A1	
	(b)		$7+6+11 = 12+7+x$ $---M1$ $x = 5$ $---A1$	

7	(a)		$3y+15+4y+2y-20+y+15=360 \quad ---M1$ $10y=350$ $y=35 \quad ---A1$	
	(b)		$\text{Probability}=\frac{5(35)+15}{360}$ $=\frac{19}{36} \quad ---A1$	
8	(a)		k = 12 --- A1	
	(b)		$Mean=\frac{200(15)+240(50)+280(23)+320(12)}{100} \quad ---M1$ $=\frac{25280}{100}$ $=\$252.80 \quad ---A1$	
	(c)		$\text{Probability}=\frac{23+12}{100}$ $=\frac{7}{20} ---A1$	
9	(a)		$\pi r^2=201---M1$ $r=7.99877$ $\approx 8.00 \quad cm---A1$	
	(b)		$\frac{1}{3}\pi(7.99877)^2 h=662 \quad ---M1$ $h=9.8806$ $\approx 9.88\,cm \quad ---M1$	
	(c)		$Volume=\left(\frac{1}{2}\times\frac{4}{3}\times\pi\times 7.99877^{\ 3}\right)+\left(\pi\times 7.99877^2\times 20\right)-662---M1$ $=4429.8379$ $\approx 4430cm^3$ $Mass=4429.8379\times 0.5---M1$ $=2214.91895$ $\approx 2215g---A1$	
	(d)			

			$Slant\ height\ of\ cone = \sqrt{9.8806^2 - 7.99877^2}$ $= 9.0345cm - - - M1$ $Total\ surface\ area = 251 + (2 \times \pi \times 7.99877 \times 20) + (\pi \times 7.99877 \times 9.035) - - - M1$ $= 1483.19cm^2 - - - A1$	
10			Graph