Full Name	Class Index No	Class

Anglo-Chinese School (Barker Road)

END-OF-YEAR EXAMINATION 2022
SECONDARY TWO EXPRESS

MATHEMATICS
PAPER 1

1 HOUR 30 MINUTES

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your index number and name on all the work you hand in.
Write in dark blue or black pen.

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.
The use of an approved scientific calculator is expected, 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

This question paper consists of **14** printed pages.

Mathematical Formulae

Compound interest

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

Mensuration

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

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

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

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

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

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

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

Statistics

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

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

1 Evaluate $\dfrac{1121}{13^3 \times 4} + \sqrt{50}$, giving your answer correct to the nearest whole number.

Answer _____ [1]

---

2 The sum of three consecutive odd numbers is 105. By letting the smallest integer be x, form an equation in x and find the value of x.

Answer $x =$ _____ [2]

---

3 Factorise

(a) $9x + 3x^3 + 27xy$,

Answer _____ [1]

(b) $4x^2 - 16y^2$.

Answer _____ [2]

---

4 Spencer prepares 180 chicken wings, 240 satays and 300 curry fish balls for a party. Each guest eats the same quantity of each type of food.

(a) What is the largest number of guests he can invite, if no food of any kind is to be left over?

Answer _____ [2]

(b) How many curry fish balls does each guest eat if the largest number of guests is invited?

Answer _____ [1]

---

5 **(a)** Solve the inequality $-2x+4 \leq 3x-2$.

Answer _____ [1]

(b) Express your solution in **(a)** on the number line below. [1]

Answer

(c) Hence state the smallest integer value of x.

Answer $x =$ _____ [1]

---

6 A polygon has n sides and three of its interior angles are 123°, 100° and 77°. The remaining $(n-3)$ interior angles are each 170°. Calculate the value of n.

Answer $n =$ _____ [3]

---

7 Given that $v^2 = u^2 + 2as$,

(a) make u the subject of the formula,

Answer $u =$ _____ [2]

(b) find the positive value of u when $v = -12$, $a = 3$, and $s = 2$, giving your answer to 5 significant figures.

Answer $u =$ _____ [1]

---

8 The rate at which water flows from a valve at the foot of a tank, v cm^3/s, is directly proportional to the square root of the depth of water, h cm. If the rate is 112 cm^3/s when the depth is 64 cm, find

(a) the equation relating v and h,

Answer _____ [2]

(b) the rate of water flowing when the depth of water is 30.25 cm.

Answer _____ cm^3/s [1]

---

9 Mr C is considering transferring from School B to School I. Currently he is paying \$15 a month for the school while it is expected that the school fees for School I would be \$2400 per term. There are four terms in a year.

Calculate the percentage change in school fees if Mr C were to complete the transfer of schools.

Answer _____ % [3]

---

10 A model of an aeroplane is made using a scale of 1 : 500.

(a) Find the length of the model, in centimetres, if the length of the actual aeroplane is 50 m.

Answer _____cm [1]

(b) The wing area of the model aeroplane is 30 cm^2. Find the wing area of the actual aeroplane, in square metres.

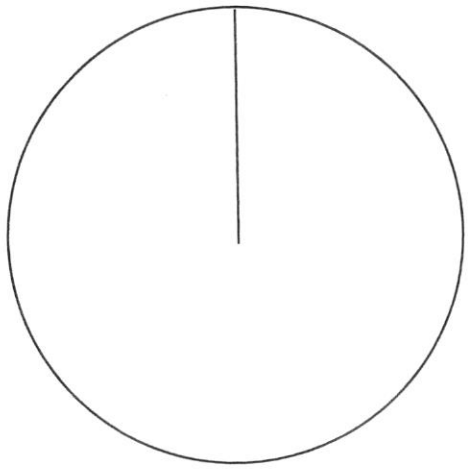
Answer _____m^2 [2]

11 Henry carried out a survey with 30 students in his class on their favourite pastime. The table below shows his results.

Favourite Pastime	Number of students
Reading	6
Watching TV	6
Surfing the Internet	10
Playing Sports	8

(a) Using ruler and protractor, draw accurately on the circle, a labeled pie chart to show these results.

Answer



[2]

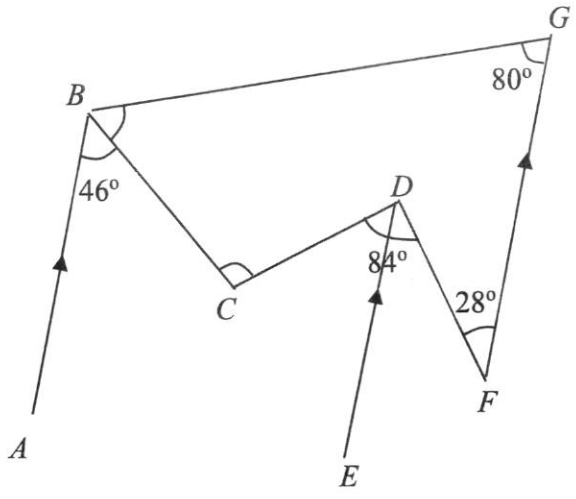
(b) One of the students is chosen at random.
Find the probability that the favourite pastime of this student is surfing the Internet.

Answer _____ [2]

12 Simplify $\left(\frac{5}{x+1}-\frac{2x}{x^2+2x+1}\right)\div\frac{3}{2x+2}$.

Answer _____ [4]

13 In the diagram below, AB, DE and FG are parallel lines.
Angle $ABC = 46°$, angle $CDF = 84°$, angle $DFG = 28°$ and angle $BGF = 80°$.



Find the value of

(a) $\angle CBG$,

Answer _____° [1]

(b) $\angle CDE$,

Answer _____° [1]

(c) reflex $\angle BCD$.

Answer _____° [2]

14 The data below shows the masses, in kg, of pupils in a small class.

Leaf for Girls	Stem	Leaf for Boys
4 3 2	3	5 7 8
8 7 3 3 1	4	0 2 5 5 5 9
8 4 3	5	1 3 5 6
	6	9

Key: 4|3 represents 34 kg for Girls and 3|5 represents 35 kg for Boys.

(a) State the mode of distribution for boys.

Answer _____kg [1]

(b) State the median of distribution for girls.

Answer _____kg [1]

(c) Calculate the mean mass for all the pupils.

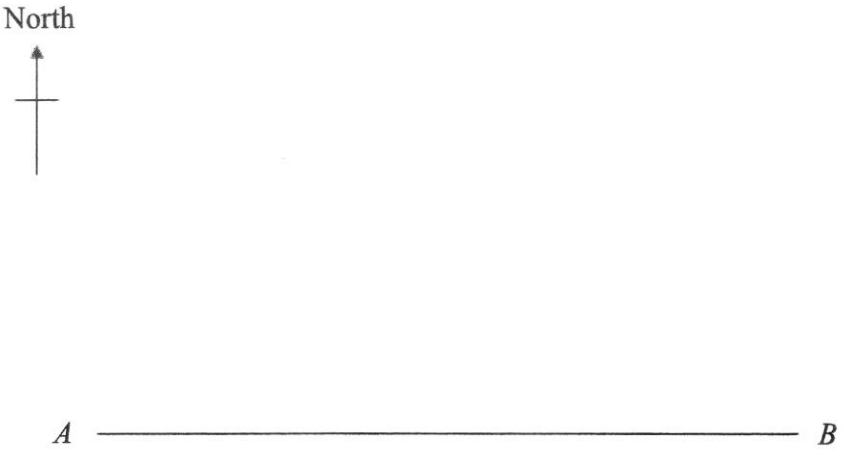
Answer _____kg [2]

(d) Explain why the mode for boys is a better measure of central of tendency as compared to the mean.

*Answer*_____

_____ [1]

15 The side AB of a triangle is drawn in the answer space below, where B is due east of A.



(a) A line l is parallel to AB and 6 cm due north of AB. Construct and label the line l. [1]

(b) C is a point on l, with the angle $BAC = 65°$. Mark the point C and complete the triangle ABC. [1]

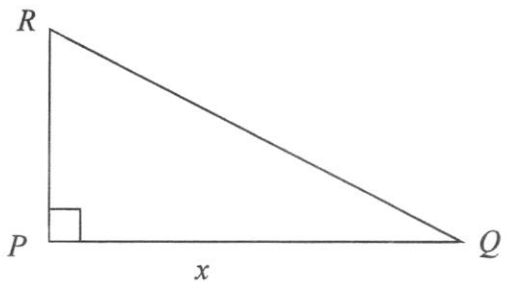
(c) Measure and write down the length of BC.

Answer _____cm [1]

(d) Name the type of triangle ABC is.

Answer _____ [1]

16



The diagram shows a right-angled triangle PQR. The length of PQ is x cm.
RP is 7 cm shorter than PQ and RQ is 2 cm longer than PQ.

(a) Write down the length of RP in terms of x.

Answer _____ cm [1]

(b) Write down the length of RQ in terms of x.

Answer _____ cm [1]

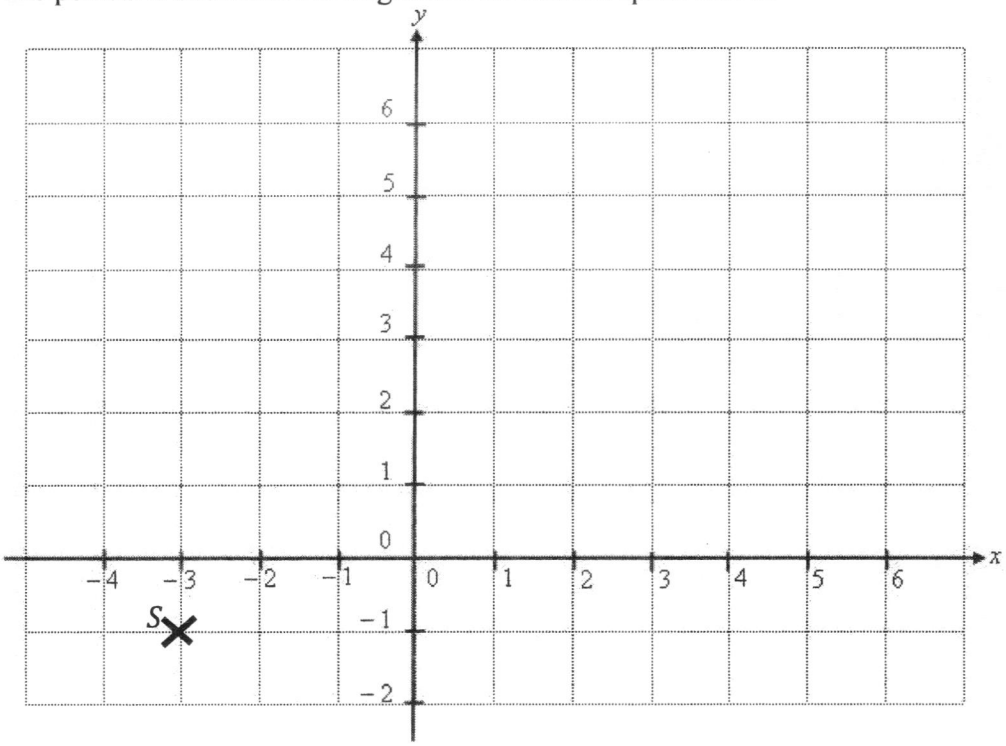
(c) Form an equation in terms of x and show that it can be reduced to $x^2 - 18x + 45 = 0$. [2]

Answer

(d) Solve the equation $x^2 - 18x + 45 = 0$.

Answer $x =$ _____ or $x =$ _____ [2]

17 The point S is shown in the diagram in the answer space below.



(a) Write down the coordinates of S.

Answer (_____, _____) [1]

(b) T is a point $(0,2)$. Plot the point T on the grid above. [1]

(c) Find the equation of the line ST.

Answer _____ [2]

(d) On the same axes, draw the line $y = 2x + 1$. [1]

(e) Join the points S and T with a straight line. Write down the coordinates of the point where the line ST meets the line $y = 2x + 1$.

Answer (_____, _____) [1]

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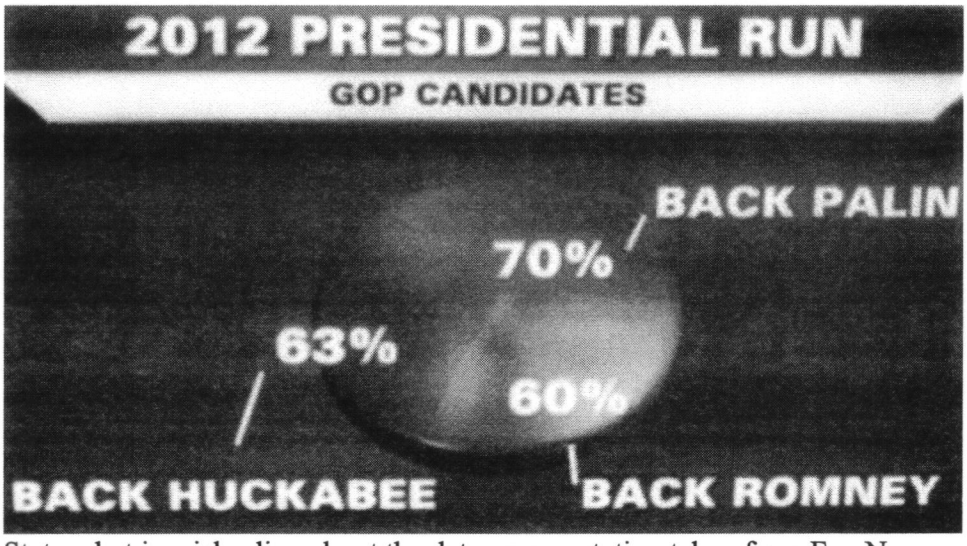
1



State what is misleading about the data representation taken from Fox News and explain why it may have happened.

Answer _____

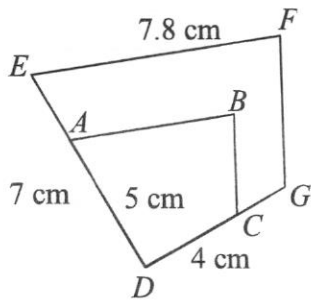
_____

_____

_____ [2]

_____

2



ABCD and *EFGD* are two similar quadrilaterals.
EF = 7.8 cm, *ED* = 7 cm, *AD* = 5 cm and *CD* = 4 cm.
Find

(a) the scale factor to transform *ABCD* to *EFGD*,

Answer _____ [1]

(b) *AB*,

Answer _____cm [1]

(c) *DG*.

Answer _____cm [1]

3 The diagram shows a pattern involving the arrangement of stars in rows.

Figure 1 | Figure 2 | Figure 3 | Figure 4

Figure	1	2	3	4	5
No. of rows	1	2	3	4	5
No. of stars	2	6	12	20	x

(a) Find the value of x.

Answer _____ [1]

(b) Given that T_n is the number of stars in the Figure n, find an expression for T_n.

Answer _____ [1]

(c) What is the maximum number of rows that can be formed given 400 stars? Explain your answer.

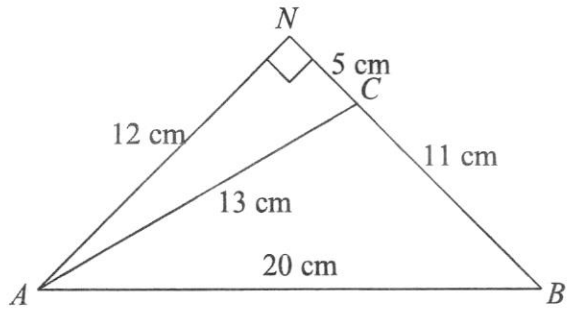
Answer _____

_____

_____ [2]

_____

4



ABC is a triangle in which $AC = 13$ cm, $BC = 11$ cm and $AB = 20$ cm. N is a point on BC produced, where $CN = 5$ cm and $AN = 12$ cm.

(a) Show angle $ANB = 90°$. [2]

Answer

(b) Expressing your answer as a proper fraction, find $\tan \angle ABC$.

Answer _____ [1]

(c) Hence find angle ABC.

Answer _____ ° [1]

5 The ratio of male to female members at a country club is 5 : 7.

(a) Find the percentage of the members that are male.

Answer _____% [2]

(b) If there are 80 male members, find the number of female members.

Answer _____ [1]

(c) If another 18 female members join the country club, find the new ratio of male to female members.

Answer _____ [2]

---

6 **(a)** Expand and simplify

(i) $3(a+4)-2a(a-2)$,

Answer _____ [2]

(ii) $(3x+4y)(2x+7y)$.

Answer _____ [2]

(b) Solve $\frac{1}{5}-\frac{2x}{3}=\frac{4}{15}$.

Answer $x =$ _____ [2]

---

7 Jurong and Changi are 42 km apart.
Orchard Road is the mid-point of Jurong and Changi.
A car travels from Jurong to Orchard Road in 20 minutes and then from Orchard Road to Changi at an average speed of 84 km/h.

(a) Express 84 km/h in m/s.

Answer _____ m/s [1]

(b) Calculate the average speed, in km/h, of the car from Jurong to Orchard Road.

Answer _____ km/h [2]

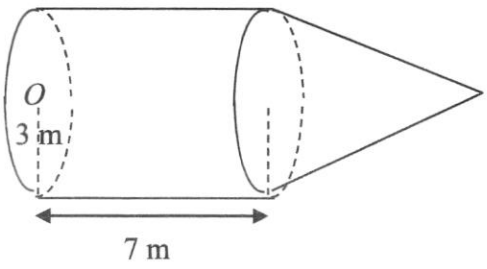
(c) Find the time taken to travel from Orchard Road to Changi.
Express your answer in minutes.

Answer _____ min [2]

(d) Calculate the average speed, in km/h, for the whole journey from Jurong to Changi.

Answer _____ km/h [2]

8



A closed container in a chemical factory is made by joining together a cylinder of radius 3 m and a cone with a base of radius 3 m as shown in the diagram. The height of the cylinder is 7 m. The point O is the centre of the base of the cone.

(a) Calculate the volume of the cylinder.
Leave your answer in terms of π.

Answer _____ m^3 [2]

(b) Given that the total volume of the container is 76.5π m^3, find the height of the cone.

Answer _____ m [2]

(c) Find the total external surface area of the container.

Answer _____ m^2 [4]

9 The table below shows some values of x and the corresponding values of y, where $y = 2x^2 + 3x - 9$.

x	-4	-3	-2	-1	0	1	2
y	a	0	-7	-10	-9	-4	b

(a) Calculate the values of a and b.

Answer $a =$ _____

$b =$ _____ [2]

(b) Using a scale of 2 cm to 1 unit on the x-axis and 4 cm to 5 units on the y-axis, draw the graph of $y = 2x^2 + 3x - 9$ for $-4 \leq x \leq 2$ on the grids on the next page. [3]

(c) State the coordinates of minimum point of the graph.

Answer (_____ , _____) [1]

(d) State the coordinates of the point where the graph cuts the y-axis.

Answer (_____ , _____) [1]

(e) State the equation of the line of symmetry.

Answer _____ [1]

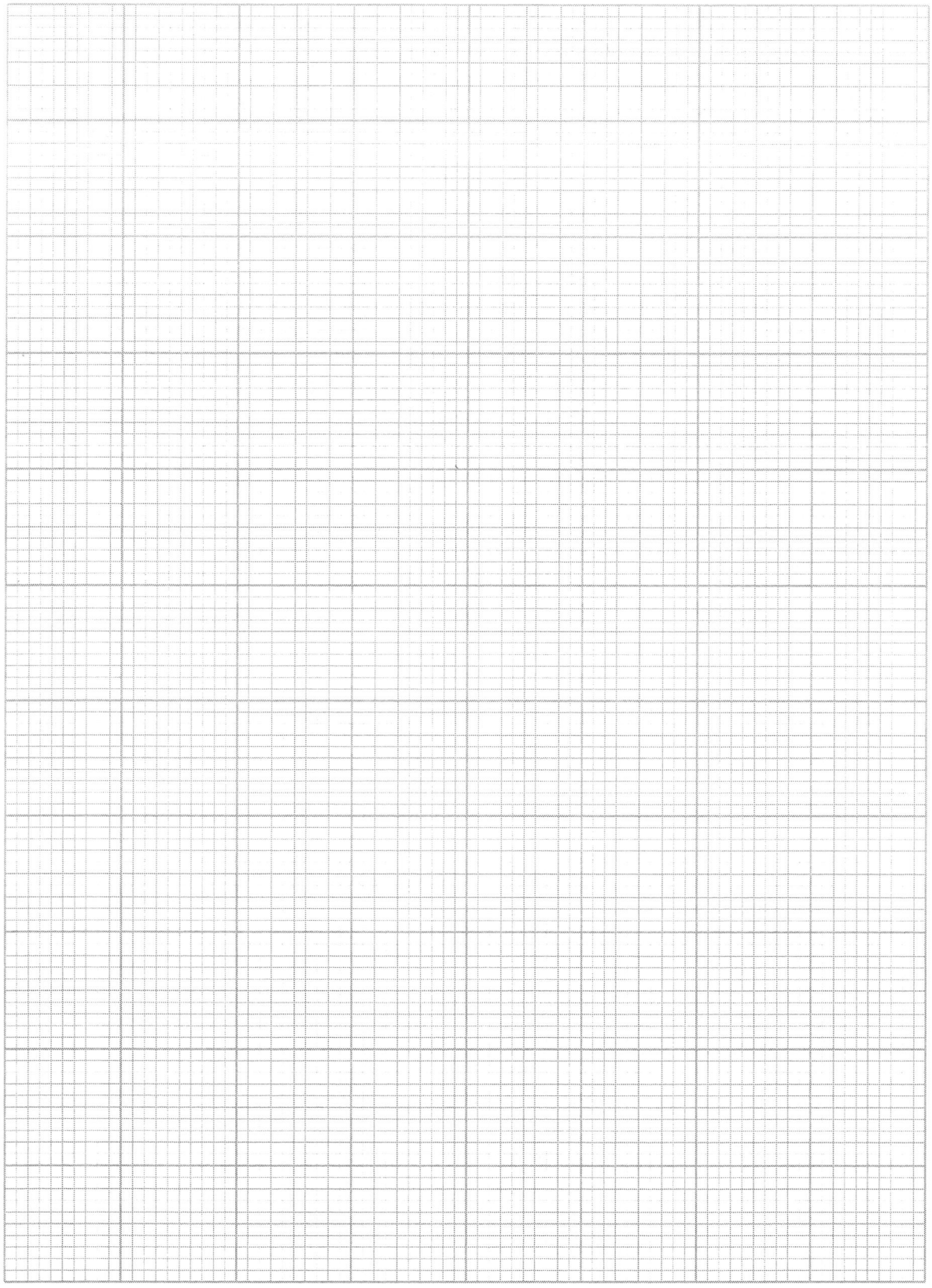
(f) Use your graph to find

(i) the value of y when $x = -3.5$.

Answer $y =$ _____ [1]

(ii) the value(s) of x when $y = -8$.

Answer $x =$ _____ [1]



10 On behalf of the school, Mr Tan will organize a learning journey for the entire Secondary Two cohort to watch a play titled "Don't Know Don't Care" at the Esplanade Theatre Studio. The Secondary Two cohort consists of 341 students and the maximum capacity of the Esplanade Theatre Studio is 220. There are multiple days available for the play.

Each ticket will cost $23 and for every 20 student tickets purchased per performance, one complimentary teacher ticket will be issued. All secondary schools may use the Tote Board Arts Grant to subsidise up to 50% of the programme cost.

As part of school procedure, the students will have to be transported from school to the esplanade and back, and every 20 students must be accompanied by at least 1 teacher. The cost for a one-way trip per bus is $110 and the cost for a two-way trip per bus is $140. Each bus can hold up to a maximum of 45 people.

(a) Find the minimum number of teachers required for this trip.

Answer _____ [2]

(b) Find the minimum cost the school will have to pay for this learning journey.

Answer $_____ [5]

(c) In a bid to convince Mr Tan to allow 19 members of the Drama CCA to go along for the learning journey, Jake claims that it is more cost efficient (cost per person) for the 19 drama members to go along. By showing proper working, determine if Jake's claim is correct.

Answer _____

_____

_____

_____ [4]

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Marking Scheme
Secondary 2 Express
Mathematics Paper 1
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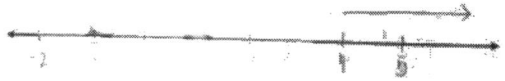
1		7
2		$x+(x+2)+(x+4)=105$
		$x=33$
3	(a)	$3x(3+x^2+9y)$
	(b)	$4(x^2-4y^2)$
		$=4(x+2y)(x-2y)$
4	(a)	2 | 180 240 300 2 | 90 120 150 3 | 45 60 75 5 | 15 20 25 3 4 5
		60 guests
	(b)	5
5	(a)	$x \geq \frac{6}{5}$
	(b)	
	(c)	2
6		$(n-3)\times 170+123+100+77=(n-2)\times 180$
		$58n=870$
		$n=15$

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7	(a)	$u^2 = v^2 - 2as$			
		$u = \pm\sqrt{v^2 - 2as}$			
	(b)	11.489			
8	(a)	$k = 14$			
		$v = 14\sqrt{h}$			
	(b)	77			
9		Annual fee for School B = 180 Annual fee for School I = 9600			
		Percentage change $= \frac{9600 - 180}{180} \times 100\%$			
		$= 5233\frac{1}{3}$ or 5230 (3sf)			
10	(a)	10 cm			
	(b)	1 cm^2 : 25 m^2			
		750 m^2			

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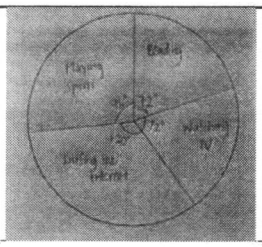
11	(a)				
	(b)	$\text{Probability} = \frac{10}{6+6+10+8}$			
		$= \frac{1}{3}$			
12	(a)	$\left(\frac{5}{x+1} - \frac{2x}{(x+1)^2}\right) \div \frac{3}{2(x+1)}$			
		$= \left(\frac{5x+5-2x}{(x+1)^2}\right) \times \frac{2(x+1)}{3}$			
		$= \frac{2(3x+5)}{3(x+1)}$			
13	(a)	54			
	(b)	56			
	(c)	$(180-46)+(180-56)$			
		$= 258$			
14	(a)	45			
	(b)	43			

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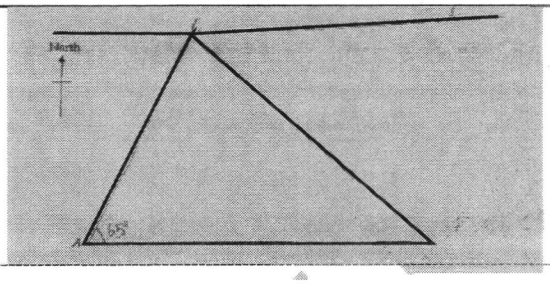
	(c)	$\frac{1146}{25}$			
		= 45.84			
	(d)	There is an outlier value of 69 kg which would affect the mean greatly and therefore the mode would be a better measure of central tendency.			
15	(a) and (b)				
	(c)	9.1 cm			
	(d)	Scalene triangle			
16	(a)	$x-7$			
	(b)	$x+2$			

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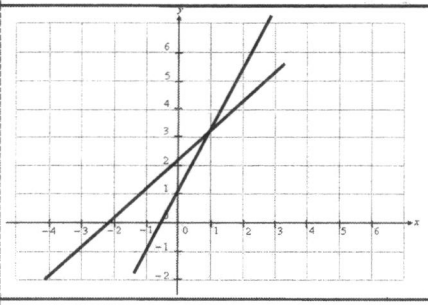
	(c)	$(x-7)^2+x^2=(x+2)^2$			
		$x^2-14x+49+x^2=x^2+4x+4$ $2x^2-14x+49=x^2+4x+4$ $x^2-18x+45=0$ (Shown)			
	(d)	$(x-3)(x-15)=0$			
		$x=3$ or 15			
17	(a)	$(-3,-1)$			
	(b) and (d)				
	(c)	Gradient = 1			
		$y=x+2$			
	(e)	(1,3)			

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1		The total percentage of the 3 categories add up to more than 100%			
		Each person surveyed may have chosen more than 1 candidate instead of only 1.			
2	(a)	$\frac{7}{5}$ or 1.4			
	(b)	5.57 (3sf) or $5\frac{4}{7}$			
	(c)	5.6 or $5\frac{3}{5}$			
3	(a)	30			
	(b)	$n(n+1)$			
	(c)	Since $400 = 20 \times 20$, maximum number of stars use is $19 \times 20 = 380$			
		Hence the maximum number of rows is 19			
4	(a)	$AB^2 = 20^2$ $= 400$ $AN^2 + NB^2 = 12^2 + (5+11)^2$ $= 144 + 256$ $= 400$			
		Since $AB^2 = AN^2 + NB^2$, by the converse of Pythagoras' Theorem, Triangle ANB is a right-angled triangle, therefore angle ANB is $90°$.			
	(b)	$\frac{3}{4}$			
	(c)	$36.9°$ (1dp)			

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5	(a)	Percentage $= \frac{5}{12} \times 100\%$			
		$= 41.7\%$ (3sf) or $41\frac{2}{3}\%$			
	(b)	112			
	(c)	ratio $= 80 : 112 + 18$ $= 80 : 130$			
		$= 8 : 13$			
6	(a)	(i) $3a + 12 - 2a^2 + 4a$			
		$= -2a^2 + 7a + 12$			
		(ii) $6x^2 + 21xy + 8xy + 28y^2$			
		$= 6x^2 + 29xy + 28y^2$			
	(b)	$\frac{3}{15} - \frac{10x}{15} = \frac{4}{15}$ $3 - 10x = 4$			
		$x = -\frac{1}{10}$ (or -0.1)			

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7	(a)	23.3 (3sf) or $23\frac{1}{3}$			
	(b)	Average speed $= 21 \div \frac{20}{60}$			
		$= 63$ km/h			
	(c)	Time $= 21 \div 84$ $= \frac{1}{4}$ h			
		$= 15$ min			
	(d)	Average speed $= 42 \div \left(\frac{20+15}{60}\right)$			
		$= 72$ km/h			
8	(a)	Volume $= \pi \times 3^2 \times 7$			
		$= 63\pi$ m^3			
	(b)	$\frac{1}{3}\pi \times 3^2 \times h = 76.5\pi - 63\pi$			
		$h = 4.5$			
	(c)	slant height $= \sqrt{4.5^2 + 3^2}$ $= \sqrt{29.25}$ $= 5.408326913$			
		Total $= \pi \times 3^2 + 2 \times \pi \times 3 \times 7 + \pi \times 3 \times \sqrt{29.25}$			
		$= 211.1935056$ $= 211$ m^2 (3sf)			

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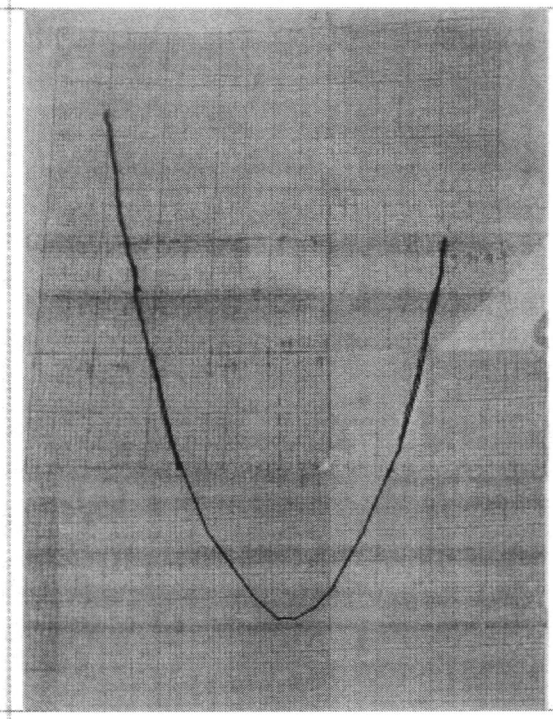
9	(a)	$a = 11$ $b = 5$			
	(b)				
	(c)	$(-0.75, -10.125)$			
	(d)	$(0, -9)$			
	(e)	$x = -0.75$			
	(f)	(i) $y = 5$			
		(ii) $x = 0.3$ or -1.8			
10	(a)	$341 \div 20 = 17.05$			
		18			
	(b)	Cost of tickets = $341 \times 23 + 23 = 7866$			

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		Min cost of tickets (after subsidy) = $3933			
		Minimum number of buses needed $= 210 \div 42 + 149 \div 42 \approx 9$			
		Cost of bus = $9 \times 140 = 1260$			
		Total = $5193			
	(c)	Current cost per person = $\frac{5193}{341+18} = 14.46518106$			
		Additional cost = $(19 \times 23 - 23) \times 50\% = 207$			
		New cost per person = $\frac{5013+207}{341+18+19} = 14.28571429$			
		Jake's claim is correct as the new cost per person is less than the current cost per person			