Name: ..... Teacher: .....

SYDNEY TECHNICAL HIGH SCHOOL

YEAR 10 YEARLY EXAM

Mathematics

Time Allowed: 90 minutes

Total Marks: 75

Section I: Q1-10 multiple choice (10 Marks)

Section II: Q11-15 (65 Marks)

General Instruction

- There is a multiple choice answer sheet in your answer book for Q1-10. Shade the correct response. Allow approximately 15 minutes for this section.
- All answers to Q11-15 must be written in your answer book, with all necessary working shown.
- Marks may not be given if required working is not shown.
- Marks are indicated next to each question.
- Use blue or black pen only.
- Calculators may be used.
- **START EACH QUESTION ON A NEW PAGE.**

Section 1 (10 Marks)

Use the multiple choice answer sheet provided in the answer booklet to answer the following questions.

1. A group of people were surveyed about their travel intentions during the next 6 months. The results are displayed in the two way table below.

	Age 20 – 40	Age 40 – 60	Totals
Intending to travel	15	25	40
Not intending to travel	42	60	102
Totals	57	85	142

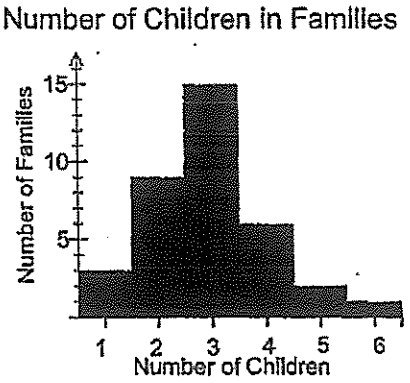
Approximately what percentage of people surveyed are not intending to travel in the next six months?

(A) 28% (B) 39% (C) 60% (D) 72%

2. If $t = -4$, what is the value of $\frac{8-2t^2}{t}$?

(A) -18 (B) -10 (C) 6 (D) 14

3. A group of students was surveyed to determine how many children were in each of their families. The results are shown in the column graph below.



How many families were surveyed?

(A) 6 (B) 15 (C) 36 (D) 106

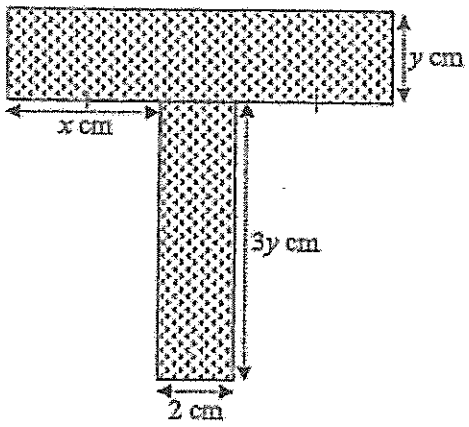
4. The surface area of an open cylinder is 6250cm² and the radius is 20cm. What is the height of the cylinder, correct to one decimal place? Question error.

(A) 4.9cm (B) 29.7cm (C) 59.5cm (D) 49.7cm

5. A bag contains 20 marbles. There are three different colours of marbles in the bag; red, white and blue. The probability of selecting a red marble is $\frac{2}{5}$. What is the maximum possible number of blue marbles in the bag?

(A) 8 (B) 10 (C) 11 (D) 12

6. A telecommunications company has a "T" as its signature sign.



Which of these expressions would give the area (in cm²) of this sign?

(A) $2xy + 6y$ (B) $2xy + 8y$

(C) $4xy + 6y$ (D) $2x + 8y$

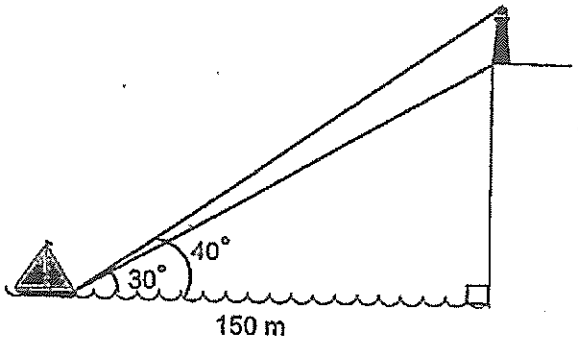
7. Which of the following correctly expresses r as the subject of

$$d = \frac{3r}{5} + w \text{ ?}$$

(A) $r = \frac{5d-5w}{3}$ (B) $r = 15d - 15w$

(C) $r = \frac{5d-w}{3}$ (D) $r = \frac{5d}{3} - w$

8. A person on a boat, 150m from shore, measures the angles of elevation to the bottom and top of a lighthouse on a cliff to be 30° and 40° respectively. The angles of elevation are shown in the diagram below.

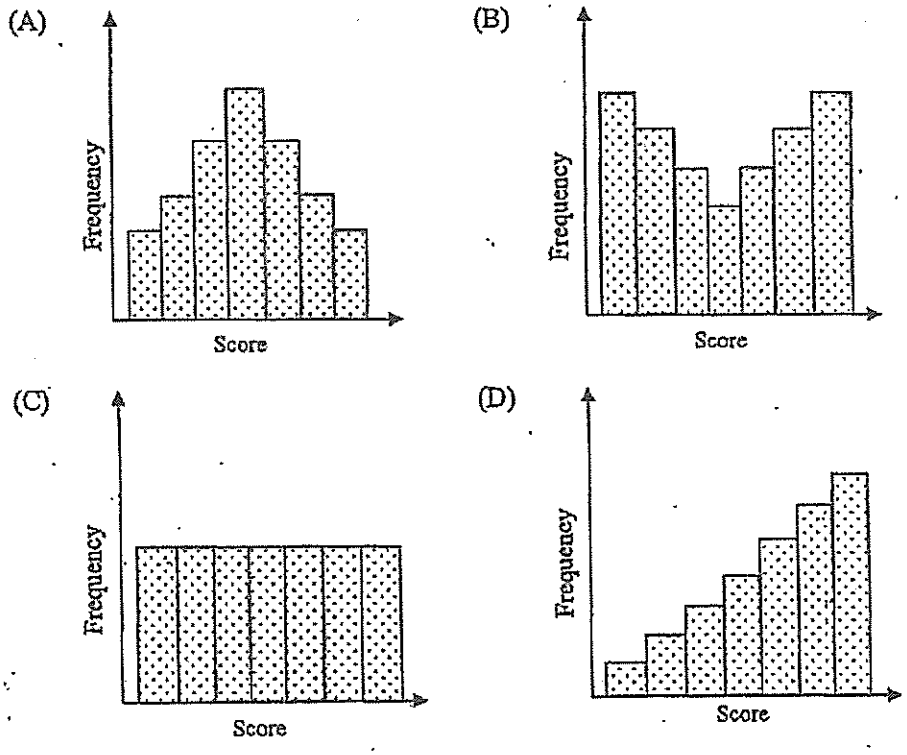


Not to scale

What is the height of the lighthouse to the nearest metre?

(A) 26m (B) 39m (C) 60m (D) 126m

9. Which of the graphs below shows data with the largest standard deviation?



10. Life expectancy data for men and women was collected from a number of countries in 2012. The relationship between the two was found to be approximated by the equation

$$y = 0.8x + 9.4$$

where x is the life expectancy of a woman and y is the life expectancy of a man.

Using this equation, approximately how much longer (in years) is a woman expected to live if a man has a life expectancy of 75?

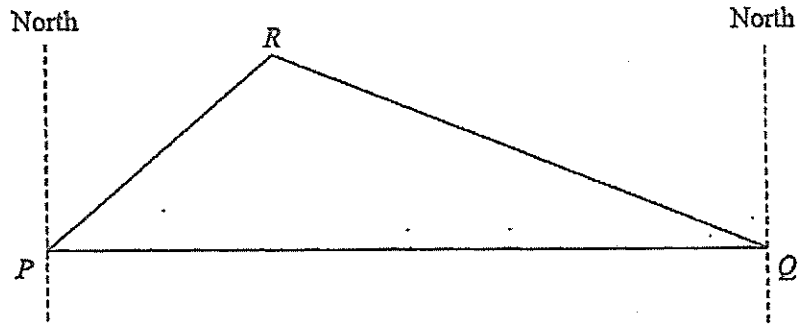
(A) 5.6 (B) 7 (C) 8.6 (D) 9.6

Section 2 (65 Marks)

Answer all the questions, starting each question on a new page in your answer booklet with the question number at the top of the page.

Question 11 (13 Marks) Mark

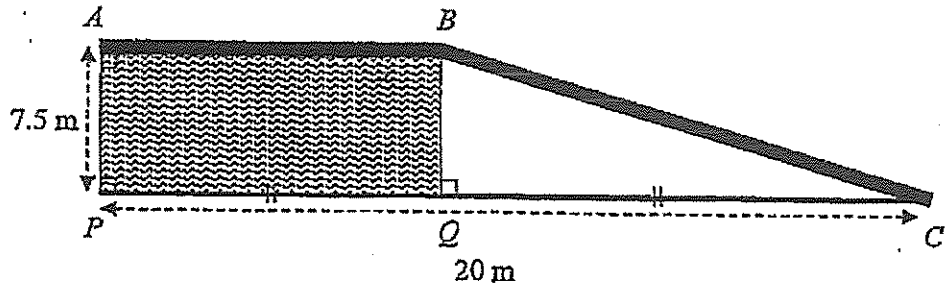
(a) Town Q is due East of Town P in the following diagram. 2



The bearing of town R from town P is 050° and the bearing of town R from town Q is 300°.

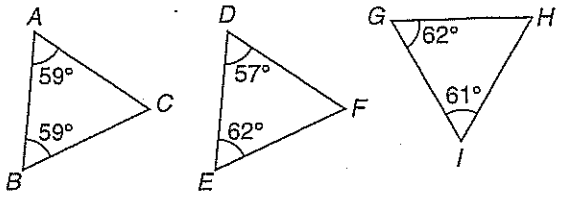
What is the size of angle PRQ ?

(b) The base PC of this boat ramp has length 20 metres and it has a maximum height above its base of 7.5m. 2

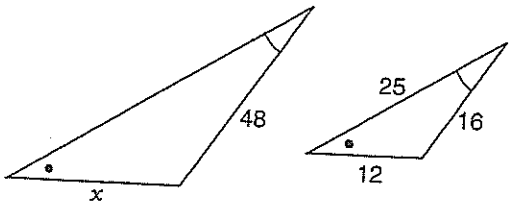


If $PQ = QC$, find the total length of the ramp from A to B to C.

(c) Which two triangles are similar and give a reason. 1



(d) The diagram shows a pair of triangles. Equal angles are marked. Calculate the length of the side marked x. 1



(e) Calculate the lower quartile, upper quartile and interquartile range for 3

3, 9, 10, 12, 16, 19, 25

(f) Solve $x^2 + 7x - 60 = 0$ 2

(g) Find the value of x if 1

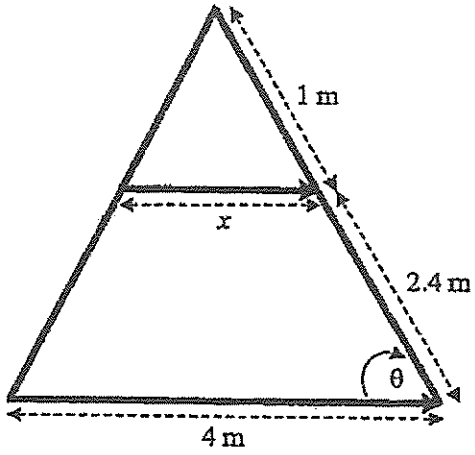
$$\sqrt{3} \times 2\sqrt{2} = \sqrt{x}$$

(h) Factorise fully $3x + 9 + xy + 3y$ 1

Question 12 (13 Marks) - Start a new page

Mark

(a) The diagram shows an A-frame isosceles triangle structure for a roof. A horizontal support beam (parallel to the base of the frame) has length x metres, as shown.



(i) Find θ to the nearest degree 2

(ii) By using similar triangles find x correct to one decimal place. 2

(b) Solve for x: 2

$$\frac{2x-1}{5} = \frac{x}{3} - 1$$

(c) For the parabola $y = -x^2 + 2x + 3$ find

(i) the y intercept 1

(ii) the x intercepts 1

(iii) the vertex 1

(iv) Sketch this parabola on a number plane showing all of the above features 2

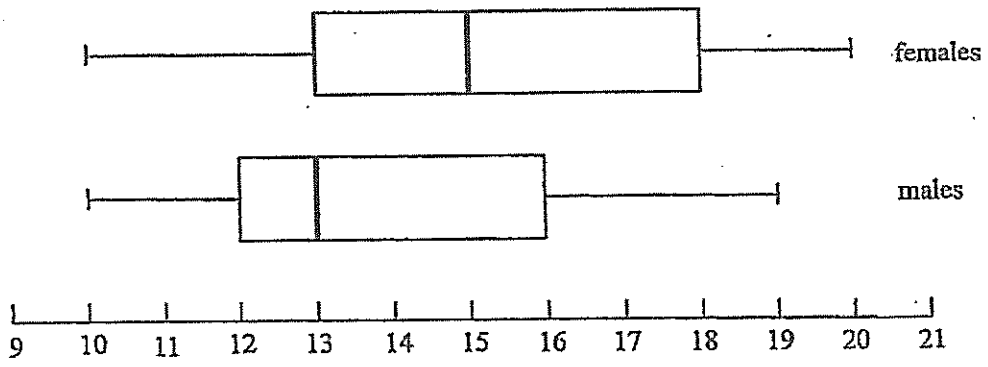
(d) If $(\sqrt{3} + \sqrt{5})^2 = a + b\sqrt{15}$ 2

find a and b

Question 13 (13 Marks) - Start a new page

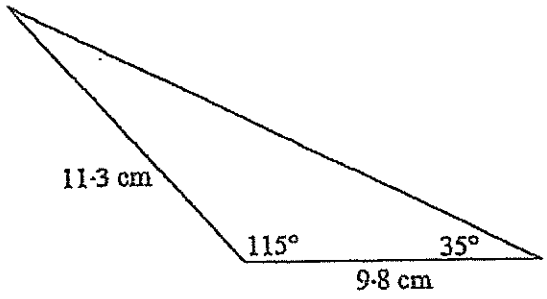
Mark

(a) The times, in minutes, for male and female swimmers to complete an 800m race are displayed in the box and whisker plots below. 1



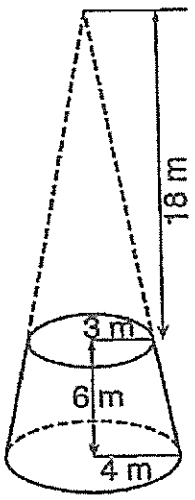
There were 80 male swimmers in the event. An equal number of male and female swimmers completed the course in 13 minutes or less. How many females completed the race?

(b)



What is the area of this triangle, correct to the nearest square centimetre? 2

(c)



A sawn-off cone makes a good model for the shape of the Gemini spacecraft used in the US space program in the 1960's. Calculate the volume of this sawn-off cone. 2

(d) Solve $\tan\theta = -1$ for $0 \leq \theta \leq 180°$ 1

(e) 2

Taxable income	Tax on this income
\$0 - \$18 200	Nil
\$18 200 - \$37 000	19c for each \$1 over \$18 200
\$37 001 - \$80 000	\$3 572 plus 32.5c for each \$1 over \$37 000
\$80 000 - \$180 000	\$17 547 plus 37c for each \$1 over \$80 000
\$180 001 and over	\$54 547 plus 45c for each \$1 over \$180 000

Calculate the tax payable on an income of \$150 000.

(f) Solve simultaneously for x and y: 2

$$x + y = 3$$

$$2x + 3y = 10$$

(g) (i) What are the equations of the asymptotes on 1

$$y = \frac{-4}{x}?$$

(ii) Sketch the curve on a number plane giving the coordinates of one point on the curve. 2

Question 14 (13 Marks) - Start a new page

Mark

(a) 2

TEST	CLASS MEAN	CLASS STANDARD DEVIATION	ESTI'S MARK
ENGLISH	75	5	80
MATHEMATICS	55	15	80
SCIENCE	60	10	80

Which was Esti's worst test result when compared with the rest of the class? (Show working or give a reason).

(b) A soccer ball has a surface area of $1385cm^2$

(i) Find its radius correct to one decimal place. 1

(ii) Find its volume to the nearest cm^3. 1

(c) On a number plane, sketch the region satisfied by both $y \geq 2^x$ and $y \leq x + 2$ 2

(d) In a group of 40 students, 17 study German, 20 study French and 5 study neither language.

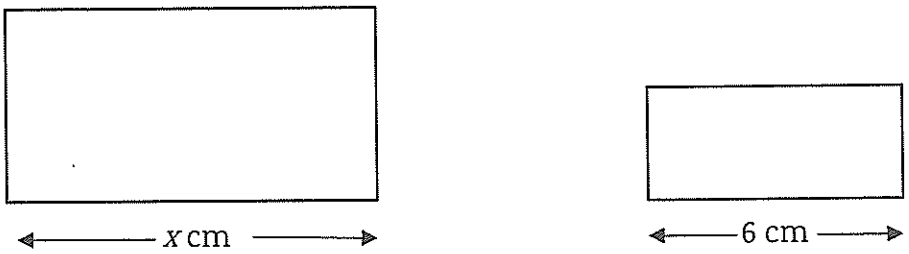
(i) Draw a Venn diagram showing this information. 1

(ii) What is the probability that a randomly chosen student studies German only? 1

(e) Mr Sender has two similar gas cylinders for his BBQ, one holds 4kg and the other 9kg. If the 9kg cylinder is 42cm high, find the height of the 4kg cylinder to the nearest centimetre. In this question, mass can be considered as volume. 2

(f) The midpoint of $(x, 11)$ and $(5, -3)$ is $(-1, 4)$. Find x. 1

(g) 2

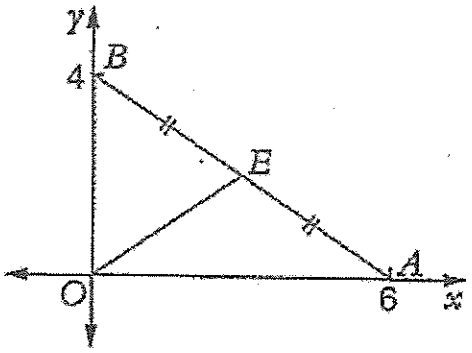


Two similar rectangles have their areas in the ratio of 9:4. If the length of the smaller rectangle is 6cm, find the length x of the larger one.

Question 15 (13 Marks) - Start a new page

Mark

(a)



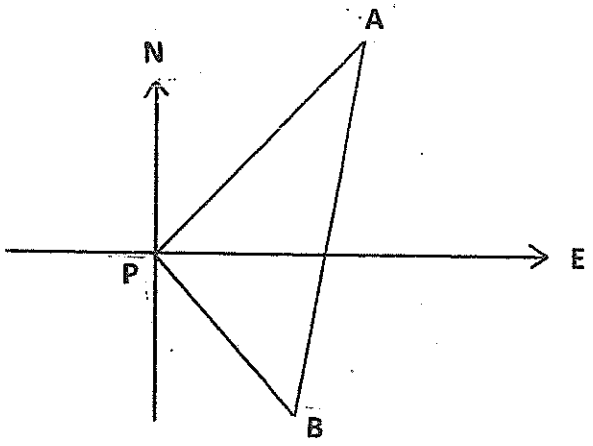
A right angled triangle OAB is shown

(i) Find the coordinates of E 1

(ii) Show the length of OE equals the length of EB 1

(iii) Find the equation of the circle with centre E passing through O, A and B 2

(b)



In the diagram boat A sails 10km from port P on a bearing of 040°. Boat B sails 6km from port P on a bearing of 140°.

(i) Find the distance AB, correct to 1 decimal place. 2

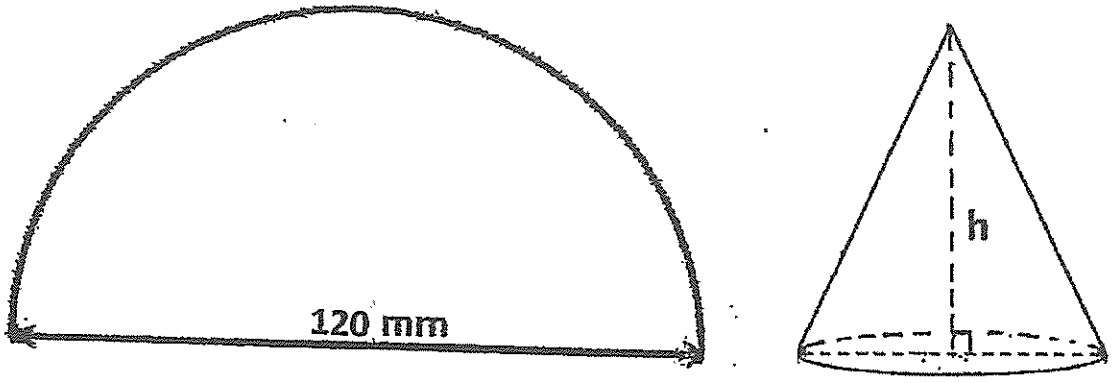
(ii) Find the angle PBA to the nearest degree using the Sine Rule. 2

(iii) Hence find the bearing of A from B to the nearest degree. 1

(c) Madeline works a 40 hour week at a fixed hourly rate. She receives a holiday loading that is $17\frac{1}{2}\%$ of four weeks pay. Her holiday loading last year was \$602. Find her hourly rate of pay. 2

PLEASE TURN OVER

(d) 2



Not to scale

The semi circle above is bent around to form a cone. Find the perpendicular height h of this cone.

Student Copy

Student Name: _____ Teacher Name: _____

2018 Year 10 Yearly Solutions

Section 1

Question 4, no correct answer

1. D 2. C 3. C 4. ~~D~~ 5. C

6. B 7. A 8. B 9. B 10. B

Section 2

11a. 110° b. $BC^2 = 7 \cdot 5^2 + 10^2$, $BC = 12 \cdot 5$, $\therefore AB + BC = 22 \cdot 5$ c. Δ's DEF and GHI Equiangular

d) $\frac{x}{12} = \frac{48}{16}$, $\therefore x = 36$ e. $Q_1 = 9$, $Q_3 = 19$, $I.R. = 10$ f. $x^2 + 7x - 60 = 0$, $(x-5)(x+12) = 0$, $x = 5$ or -12

g. $2\sqrt{6} = \sqrt{x}$, $x = 24$ h. $3x + 9 + xy + 3y$, $3(x+3) + y(x+3)$, $(3+y)(x+3)$

12. a(i) $\cos\theta = \frac{2}{3 \cdot 4}$, $\theta = 54^\circ$ (ii) $\frac{x}{4} = \frac{1}{3 \cdot 4}$, $x = 1 \cdot 2$ b. $\frac{2x-1}{5} = \frac{x}{3} - 1$, $3(2x-1) = 5x - 15$, $6x - 3 = 5x - 15$, $x = -12$

Student Name: _____ Teacher Name: _____

c (a) Let $x = 0$, $y = 3$

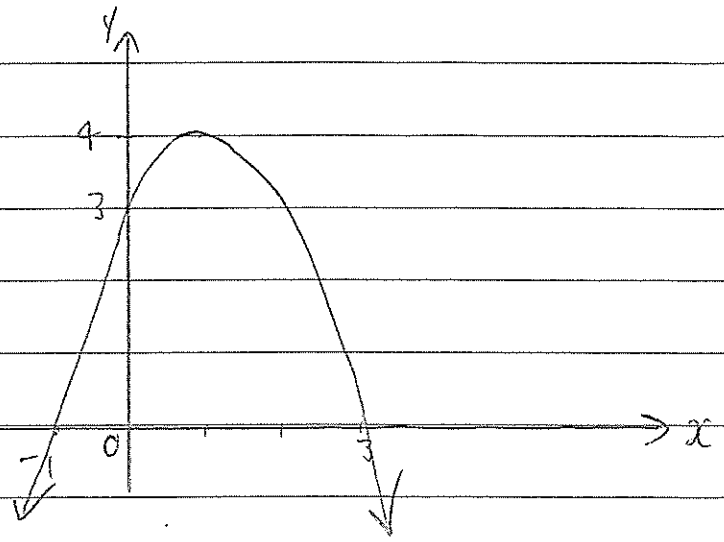
(ii) $0 = -x^2 + 2x + 3$

$0 = x^2 - 2x - 3$

$0 = (x+1)(x-3)$

$x = -1$ or 3

(iii) $(1, 4)$



d. $(\sqrt{3} + \sqrt{5})^2 = a + b\sqrt{15}$

$3 + 2\sqrt{15} + 5 = a + b\sqrt{15}$

$8 + 2\sqrt{15} = a + b\sqrt{15}$

$a = 8$ and $b = 2$

13. a. 160 b. $A = \frac{1}{2} \times 11.3 \times 9.8 \times \sin 115$

$= 50 cm^2$

c. $V = \frac{1}{3} \times \pi \times 4^2 \times 24 - \frac{1}{3} \times \pi \times 3^2 \times 18$

$= 232 m^3$

d. $\tan\theta = -1$

$\theta = 135^\circ$

e. Tax $= 17547 + 0.37(150000 - 80000)$

$= \$43447$.

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f. $x + y = 3$ ①

$2x + 3y = 10$ ②

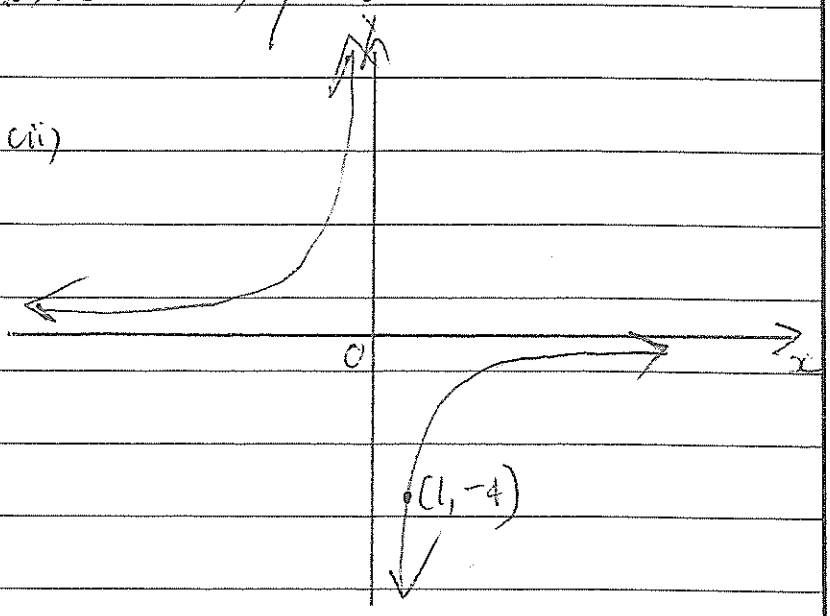
② $- 2 \times$ ①

$y = 4$

$\therefore x = -1$

g. (i) $x = 0$, $y = 0$

(ii)



4a) English as it was only 1 times the standard deviation above the mean.

b) (i) $SA = 4\pi r^2$

$1385 = 4\pi r^2$

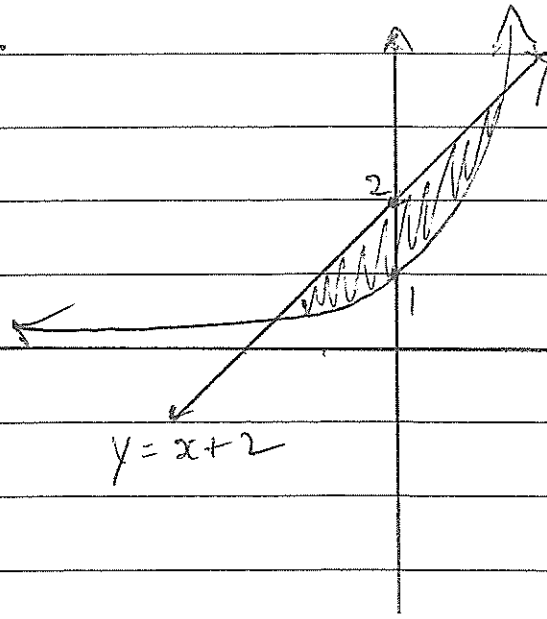
$r = 10.5 \text{ cm}$

(iii) $V = \frac{4}{3}\pi r^3$

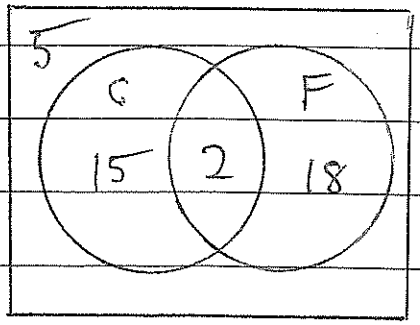
$= \frac{4}{3} \times \pi \times 10.5^3$

$V = 4847 \text{ cm}^3$

c.



d. (i)



(ii) $P(\text{German only}) = \frac{15}{40} = \frac{3}{8}$

Student Name: _____ Teacher Name: _____

(e) $\left(\frac{x}{42}\right)^3 = \frac{4}{9}$

$\therefore \frac{x}{42} = \sqrt[3]{\frac{4}{9}}$

$x = 32\text{cm}$

f. $\frac{x+5}{2} = -1$

$x + 5 = -2$

$x = -7$

g. $\left(\frac{x}{6}\right)^2 = \frac{9}{4}$

$\frac{x}{6} = \frac{3}{2}$

$x = 9\text{cm}$

15a. (i) (3, 2)

(ii) $\sqrt{3^2+2^2}$

$= \sqrt{13} = OE$

$EB = \sqrt{(3-0)^2+(4-2)^2}$

$= \sqrt{13}$

$\therefore OE = EB$

(iii) $(x-3)^2 + (y-2)^2 = 13$

b. (i) $AB^2 = 10^2 + 6^2 - 2 \times 10 \times 6 \times \cos 100$

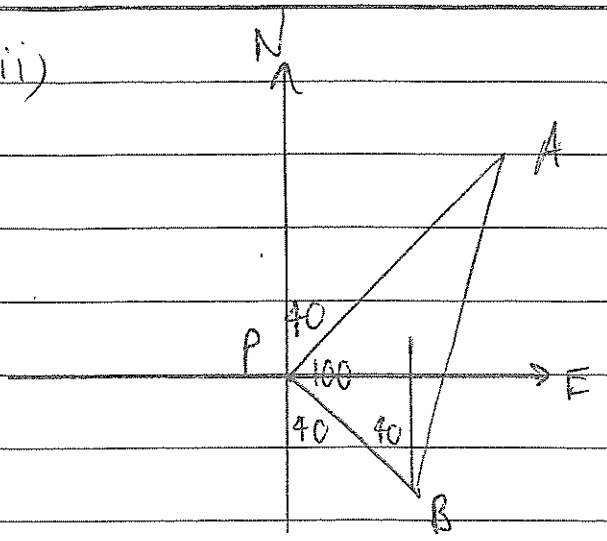
$AB = 12.5\text{km}$

(ii) $\frac{\sin B}{10} = \frac{\sin 100}{12.5}$

$PBA = 52^\circ$

Student Name: _____ Teacher Name: _____

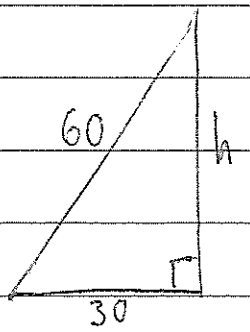
c(iii)



Bearing of A from B is
52 − 40
= 12°

c. $602 = 17½% of 4 weeks pay
$34.4 = 1% of 4 weeks pay
$3440 = 100% of 4 weeks pay
$860 = 1 weeks pay
$21.50 = hourly rate.

d. Circumference
$= \pi \times 60$
Radius of base:
$\pi \times 60 = 2\pi r$
$r = 30$
Slant height is 60



$\therefore h = \sqrt{60^2 - 30^2}$
$h = 52$cm to nearest centimetre.