Surname	Other name
LH	Worked Solutions

Candidate number				

Subject

Mathematics

Tier Foundation

Paper 3F Year 11

25th February 2022

Time: 1 hour 30 minutes

+10% 1h 39 mins +25% 1h 53 mins

Instructions

- Use **black** ink or ball-point pen.
- Answer **all** questions.
- Answer the questions in the spaces provided
- **Calculators may be used**

Information

- There are 28 questions on this paper
- The total mark for this paper is 80
- The marks for **each** question are shown in brackets
  - *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Show all of your working out.

Foundation Tier Formulae Sheet

Perimeter, area and volume

Where a and b are the lengths of the parallel sides and h is their perpendicular separation:

Area of a trapezium $= \frac{1}{2}(a + b)h$

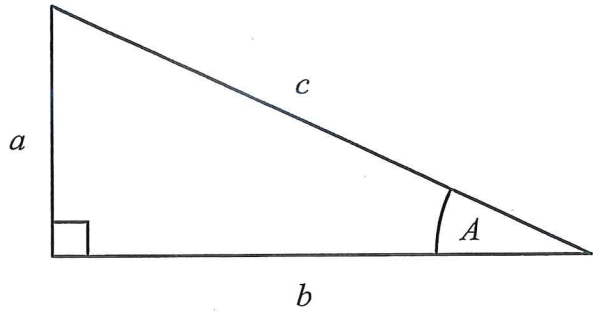
Volume of a prism = area of cross section × length

Where r is the radius and d is the diameter:

Circumference of a circle $= 2\pi r = \pi d$

Area of a circle $= \pi r^2$

Pythagoras' Theorem and Trigonometry



In any right-angled triangle where a, b and c are the length of the sides and c is the hypotenuse:

$$a^2 + b^2 = c^2$$

In any right-angled triangle ABC where a, b and c are the length of the sides and c is the hypotenuse:

$$\sin A = \frac{a}{c} \quad \cos A = \frac{b}{c} \quad \tan A = \frac{a}{b}$$

Compound Interest

Where P is the principal amount, r is the interest rate over a given period and n is number of times that the interest is compounded:

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

Probability

Where P (A) is the probability of outcome A and P (B) is the probability of outcome B:

P (A or B) = P (A) + P (B) – P (A and B)

END OF EXAM AID

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Write 45% as a decimal.

0.45

(Total for Question 1 is 1 mark)

2 Write down two factors of 35

1, 5, 7, 35

any two ok

5, 7

(Total for Question 2 is 1 mark)

3 What is the time 2 hours 40 minutes after 8.05 am?

10.45 am

(Total for Question 3 is 1 mark)

4 Work out $\frac{1}{6}$ of 66

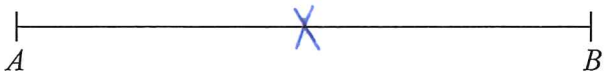
66 ÷ 6

11

(Total for Question 4 is 1 mark)

5 AB is a straight line.

Mark with a cross (×) the midpoint of AB.



(Total for Question 5 is 1 mark)

6 (a) Simplify $a \times b \times 4$

4ab

(1)

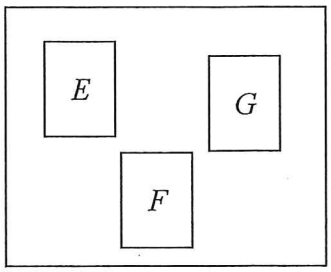
(b) Simplify $4x + 3 - x + 5$

3x + 8

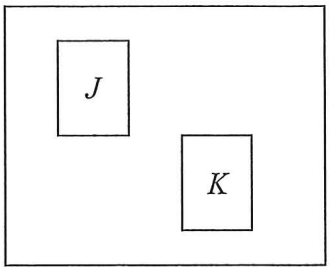
(2)

(Total for Question 6 is 3 marks)

7 There are three cards in bag **A** and two cards in bag **B**.
There is a letter on each card.



Bag **A**



Bag **B**

James takes a card from bag **A** and then a card from bag **B**.

List all the possible outcomes.

EJ GJ FJ

EK GK FK

(Total for Question 7 is 2 marks)

8 On Monday, Sandy pays for 2 plane tickets, 7 nights in a hotel and 2 theme park tickets.

	dollars
each plane ticket	600 × 2 = 1200
each night in a hotel	120 × 7 = 840
each theme park ticket	250 × 2 = 500 +

$2540

Show that Sandy pays more than 2500 dollars on Monday.

Sandy pays 2540 dollars which is more than 2500 dollars

(Total for Question 8 is 3 marks)

9 Vadim has 56 clocks.
The clocks are only red, only blue or only black.

32 of the clocks are plastic.
5 of the 14 blue clocks are plastic.
8 of the 12 red clocks are **not** plastic.

Use this information to complete the two-way table.

	Red	Blue	Black	Total
Plastic	4	5	23	32
Not plastic	8	9	7	24
Total	12	14	30	56

(Total for Question 9 is 3 marks)

10 Corina has £300 to spend on books.
Each book costs £4.85

Work out the greatest number of books Corina can buy.

£300 ÷ £4·85 = 61·855....

Corina can buy 61 books

61

(Total for Question 10 is 3 marks)

11 (a) Write 196 minutes in hours and minutes.

1 hour = 60 minutes
2 hours = 120 minutes
3 hours = 180 minutes

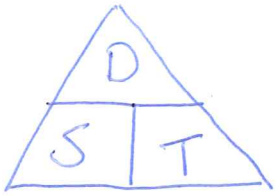
180 minutes + 16 minutes = 196 minutes

3 hours 16 minutes

(2)

A train travels x miles in 2 hours.

(b) Write down an expression, in terms of x, for the average speed of the train.



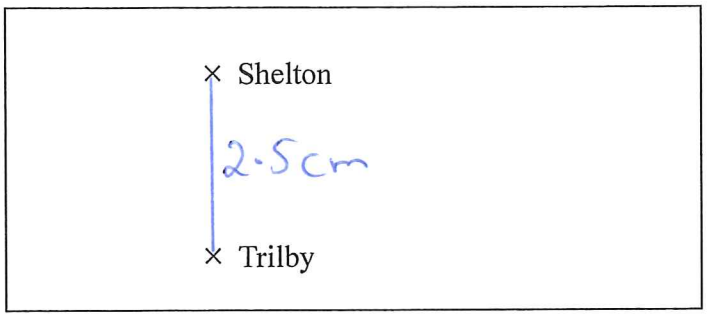
$S = \frac{D}{T} = \frac{x}{2}$

$\frac{x}{2}$ miles per hour

(1)

(Total for Question 11 is 3 marks)

12 The diagram shows two places on a map.



Scale: 1 centimetre represents 20 kilometres

(a) What is the actual distance, in kilometres, from Shelton to Trilby?

1 cm = 20 km
×2.5 ↓ ↓ ×2.5
2.5cm = 50 km

50 kilometres

(2)

On a scale drawing, the scale is given as 1 : 1200

(b) How many metres does 5 centimetres represent on this drawing?

1 cm = 1200 cm
×5 ↓ ↓ ×5
5cm = 6000 cm

m ⇄ cm (×100 / ÷100)

6000 ÷ 100

60 metres

(2)

(Total for Question 12 is 4 marks)

13 In the Northern hemisphere the ratio of the area of land to the area of water is 2 : 3

(a) Work out what percentage of the area of the Northern hemisphere is land.

L : W
2 : 3

L	L	W	W	W

% Land = $\frac{2}{5} \times 100$

= 40 %

40 %

(2)

20% of the area of the Southern hemisphere is land.

(b) Work out the ratio of the area of land to the area of water in the Southern hemisphere.

Land 20%
Water 80%

Land : Water
20 : 80
÷10 ÷10
2 : 8
÷2 ÷2
1 : 4

(2)

(Total for Question 13 is 4 marks)

14 A stadium cost £600 million.

$\frac{13}{15}$ of this cost was for the building.

The rest of the cost was for the land.

Work out the cost of the land.

Building $\frac{13}{15}$

Land $\frac{2}{15}$

cost of Land = $\frac{2}{15}$ of £600 million

$= \frac{2}{15} \times 600$

= £80 million

£ 80 million

(Total for Question 14 is 3 marks)

15 Jenna measures all the angles around a point.

Her results are 23°, 145°, 23° and 69°

Explain why these results cannot be true.

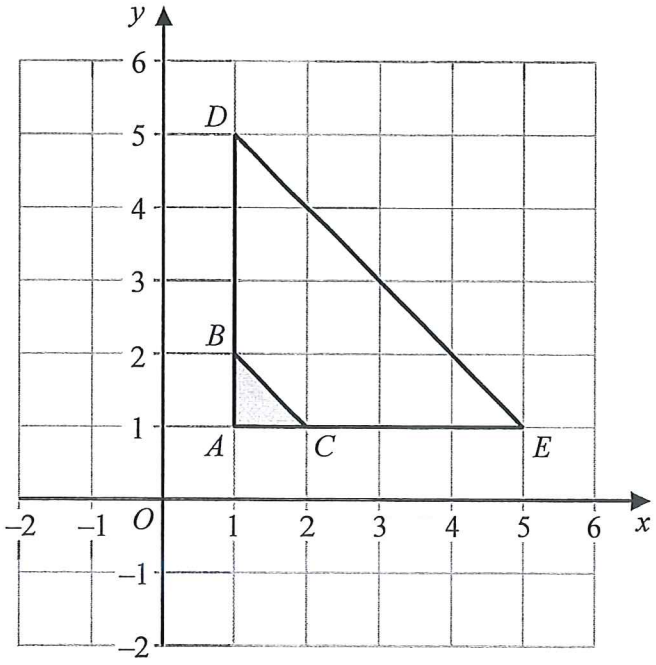
23 + 145 + 23 + 69 = 260

angles around a point add up to 360°

and so these results cannot be true

(Total for Question 15 is 1 mark)

16 Here is a diagram showing triangle *ABC* and triangle *ADE*.



Describe fully the single transformation that maps triangle *ABC* onto triangle *ADE*.

Enlargement
Centre (1,1)
Scale factor 4

(Total for Question 16 is 2 marks)

17 (a) Expand $y(y + 5)$

$y \times y$

$y \times 5$

$y^2 + 5y$

(1)

(b) Factorise $4a - 6$

$2 \times 2a - 2 \times 3$

$2(2a - 3)$

(1)

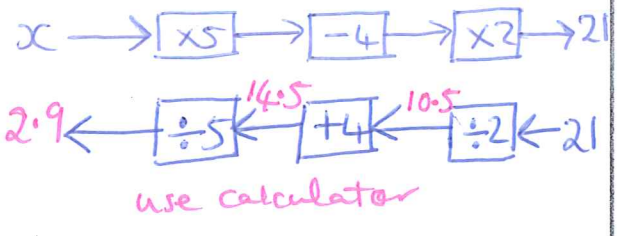
(c) Solve $2(5x - 4) = 21$

$10x - 8 = 21$ [+8

$10x = 29$ [÷10

$x = 2.9$

OR



use calculator

$x =$ 2.9

(3)

(d) Simplify $4e^2f \times 5ef^3$

$4 \times 5 = 20$

$e^2 \times e = e^3$

$f \times f^3 = f^4$

$20e^3f^4$

(2)

(Total for Question 17 is 7 marks)

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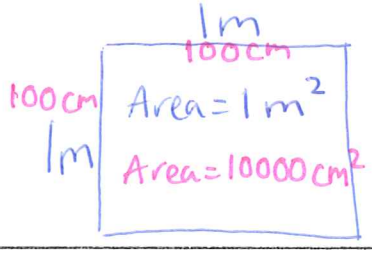
18 Change 1 m² into cm²



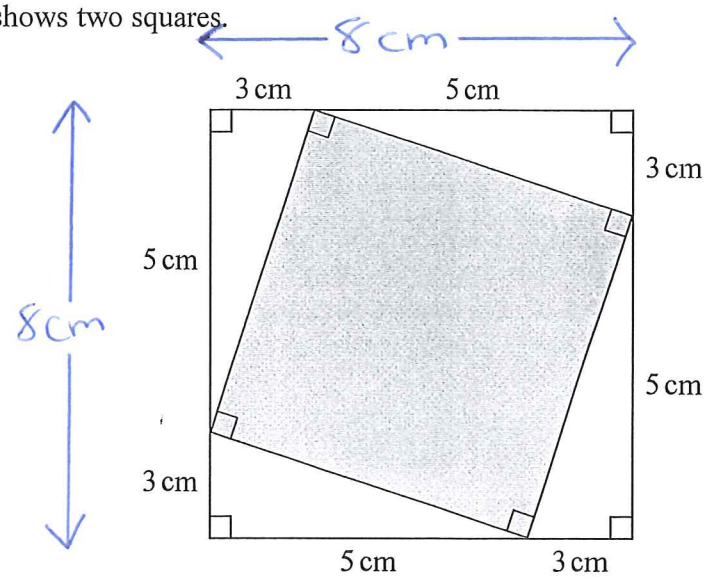
$1\,m^2 = 10\,000\,cm^2$

$m^2 \xrightarrow{\times 10000} cm^2$

10000 cm²

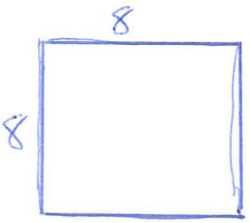
(Total for Question 18 is 1 mark)

19 This diagram shows two squares.

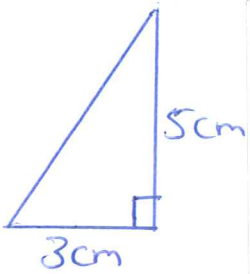


Work out the area of the square shown shaded in the diagram.

Area Large Square = 8 × 8
= 64 cm²



Area One triangle



Area = $\frac{3 \times 5}{2}$
= 7.5 cm²

Area shaded = Area Large Square − 4 × Area triangle
= 64 − (4 × 7.5)
= 64 − 30
= 34 cm²

(Total for Question 19 is 4 marks)

must include units

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

20 Here are the heights, in centimetres, of 15 plants.

15 20 25 33 17 22 25 18
22 19 32 35 24 28 19

Draw a stem and leaf diagram for these heights.

1 | 5 7 8 9 9
2 | 0 5 2 5 2 4 8
3 | 3 2 5

tip
use the space to draw an unordered stem + leaf first

1	5 7 8 9 9
2	0 2 2 4 5 5 8
3	2 3 5

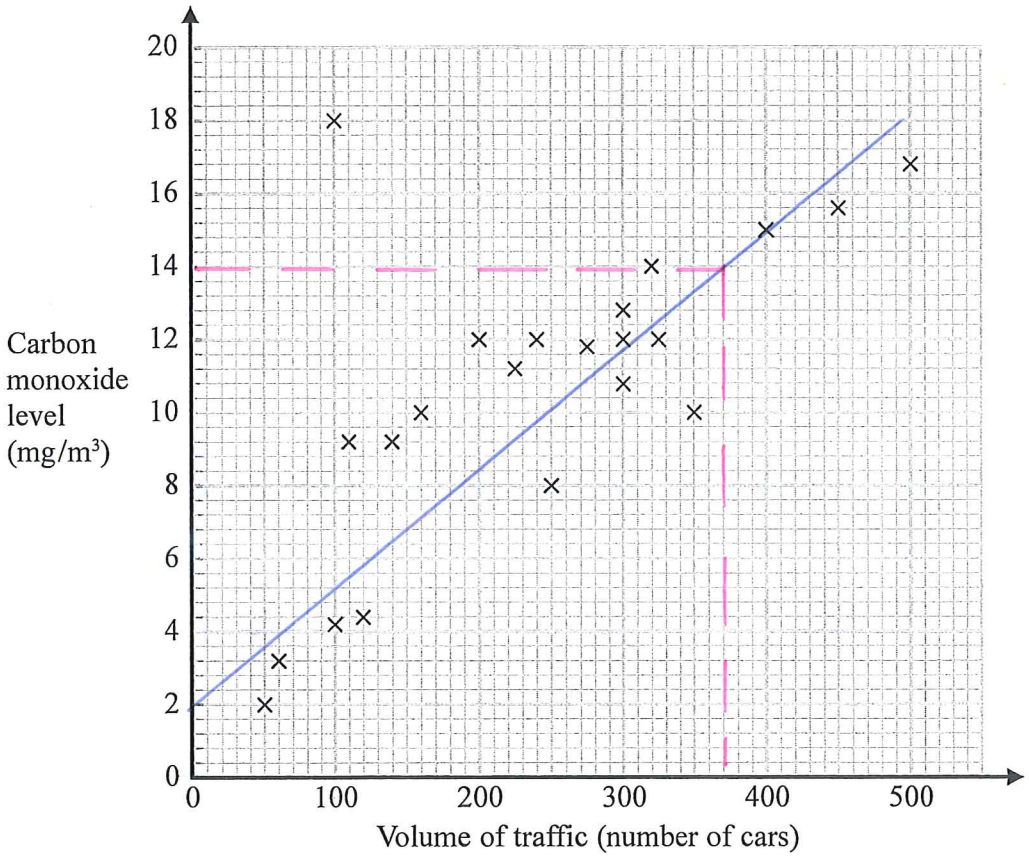
Key: 2|4 = 24cm

final stem + leaf must be ordered

(Total for Question 20 is 3 marks)

Higher Tier Q1

21 The scatter graph shows information about the volume of traffic and the carbon monoxide level at a point on a road each day for 22 days.



One point is an outlier.

(a) Write down the coordinates of this point.

(100 , 18)

(1)

For another day, 370 cars pass the point on the road.

(b) Estimate the carbon monoxide level for this day.

Always draw a line of best fit

acceptable range

12.8 → 14.8

14 mg/m³

(2)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Alfie says,

"Because there is an outlier, there is no correlation."

(c) Is Alfie correct?
You must give a reason for your answer.

No

The rest of the data fits the trend of a positive correlation and so we can ignore the outlier.

(1)

(Total for Question 21 is 4 marks)

Higher Tier Q2

22 Natalie makes potato cakes in a restaurant.

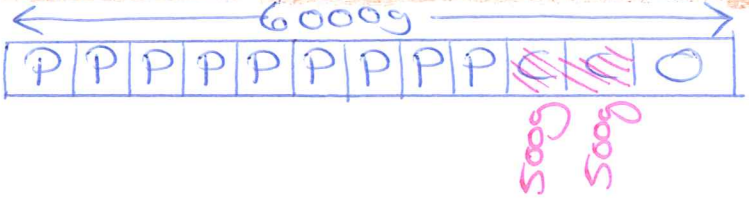
She mixes potato, cheese and onion so that

weight of potato : weight of cheese : weight of onion = 9 : 2 : 1

Natalie needs to make 6000 g of potato cakes.

Cheese costs £2.25 for 175 g.

Work out the cost of the cheese needed to make 6000 g of potato cakes.



6000 ÷ 12 = 500

Each block = 500g

Ingredients needed

Potatoes, 9 × 500g = 4500g

Cheese, 2 × 500g = 1000g

Onion, 1 × 500g = 500g

Natalie needs 1000g Cheese which is sold in packs of 175g

1000g ÷ 175g = 5.714.....

Natalie will need 6 packs of cheese

Cost 6 × £2.25 = £13.50

Note

MS accepts answers which do not use full packs of cheese

Accept £12.85 or £12.86

£ 13.50

(Total for Question 22 is 4 marks)

Higher Tier Q3

23 (a) Write 4.5×10^5 as an ordinary number.

4·5
45
450
4500
45000
450000

450,000

(1)

(b) Write 0.007 in standard form.

7×10^{-3}

(1)

(c) Work out $4.2 \times 10^3 + 5.3 \times 10^2$
Give your answer in standard form.

Use calculator to give 4730

4.73×10^3

(2)

(Total for Question 23 is 4 marks)

H Tier Q4

24 A water tank is empty.
Anil needs to fill the tank with 2400 litres of water.

Company **A** supplies water at a rate of 8 litres in 1 minute 40 seconds.
Company **B** supplies water at a rate of 2.2 gallons per minute.

1 gallon = 4.54 litres

gallon $\xrightarrow{\times 4.54}$ Litres

Company **A** would take more time to fill the tank than Company **B** would take to fill the tank.

How much more time?
Give your answer in minutes correct to the nearest minute.

Company A

2400 L

8L : 1 min 40 secs *

8L : 1.6 mins

÷8 ↓ ÷8 ↓

1L : 0.2083 mins

×2400 ↓ ×2400 ↓

2400L : 500 mins

Company A takes 500 minutes to fill the tank.

Company B takes 240.288 minutes to fill the tank.

Company B

2400 L

2.2 gallons : 1 min

9.988 L : 1 min

÷9.988 ↓ ÷9.988 ↓

1L : $\frac{250}{2497}$ mins

×2400 ↓ ×2400 ↓

2400L : 240.288 mins

500 − 240.288
= 259.711 ..... minutes
= 260 minutes (to nearest min)

(Total for Question 24 is 4 marks)

* 1 minute 40 seconds
= 60 seconds + 40 seconds
= 100 seconds
÷ 60
= $1\frac{2}{3}$ minutes (or $\frac{5}{3}$ or 1.666.....)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

H Tier Q5

add the previous two terms to get the next term.

25 The first four terms of a Fibonacci sequence are

a $\quad$ $2a$ $\quad$ $3a$ $\quad$ $5a$ $\quad$ $8a$

$8a$ ↑ $(3a+5a)$

The sum of the first five terms of this sequence is 228

Work out the value of a.

$a + 2a + 3a + 5a + 8a = 228$

$19a = 228$ $\quad [\div 19$

$a = 12$

12

(Total for Question 25 is 3 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

H Tier Q6

26 In a bag there are only red counters, blue counters, green counters and pink counters.
A counter is going to be taken at random from the bag.

The table shows the probabilities of taking a red counter or a blue counter.

Colour	red	blue	green	pink
Probability	0.05	0.15	0.5 ($x+0.2$)	0.3 (x)

The probability of taking a green counter is 0.2 more than the probability of taking a pink counter.

(a) Complete the table.

$0.05 + 0.15 = 0.2$

$1 - 0.2 = 0.8$

$P(\text{Green}) + P(\text{Pink}) = 0.8$

Let $P(\text{Pink}) = x$
and $P(\text{Green}) = x + 0.2$

$x + 0.2 + x = 0.8$

$2x + 0.2 = 0.8$ [-0.2

$2x = 0.6$ [$\div 2$

$x = 0.3$

(2)

There are 18 blue counters in the bag.

(b) Work out the total number of counters in the bag.

15% of the counters are blue
let the total number of counters be T

15% of T = 18 counters

$0.15\,T = 18$ [$\div 0.15$

$T = 120$

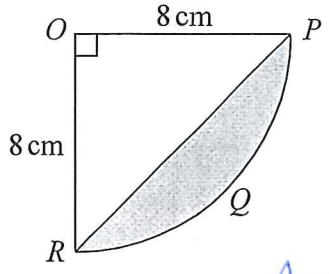
120

(2)

(Total for Question 26 is 4 marks)

H Tie Q7

27 The diagram shows a sector $OPQR$ of a circle, centre O and radius 8 cm.



OPR is a triangle.

Work out the area of the shaded segment PQR.
Give your answer correct to 3 significant figures.

Area Shaded Segment
= Area Sector − Area triangle

Area triangle $= \frac{8 \times 8}{2}$

$= \frac{64}{2}$

$= 32 \text{ cm}^2$

Area Sector $= \frac{1}{4}$ Area circle

$= \frac{1}{4} \times \pi r^2$

$= \frac{1}{4} \times \pi \times 8^2$

$= 16\pi \text{ cm}^2$

Shaded Area $= 16\pi - 32$

$= 18.26548\ldots$

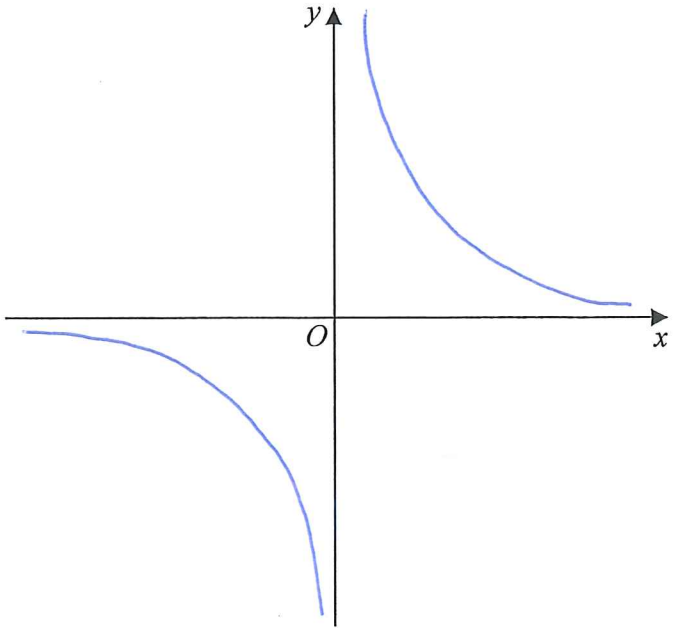
$= 18.3 \text{ cm}^2$ (3sf)

..... cm²

(Total for Question 27 is 4 marks)

Q28 not on H Tier

28 Sketch the graph of $y = \frac{1}{x}$



(Total for Question 28 is 2 marks)

TOTAL FOR PAPER IS 80 MARKS