Name: _____

GCSE (1 – 9)

Bounds

Instructions

- Use **black** ink or ball-point pen.
- Answer all questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out.**

Information

- 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.
- Check your answers if you have time at the end

1   A rectangle has a length of 21cm, to the nearest cm, and a width of 5.3cm, to the nearest mm.

(a) Work out the upper bound for the perimeter of the rectangle.
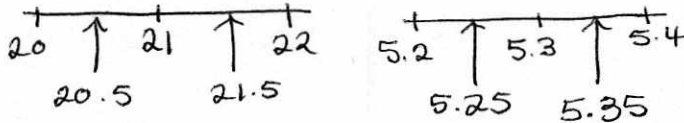
$$2(21.5) + 2(5.35)$$

........53.7........cm

(2)

(b) Work out the lower bound for the area of the rectangle.

$$20.5 \times 5.25$$

........107.625........cm²

(2)

(Total for question 1 is 4 marks)

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2   A circle has a radius of 5cm, to the nearest cm.

(a) Work out the lower bound for the circumference of the circle.
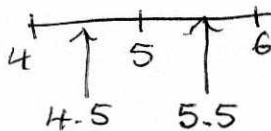
Give your answer in terms of π.

$$2\pi(4.5)$$

........9π........cm

(2)

(b) Work out the upper bound for the area of the circle.

Give your answer in terms of π.

$$\pi(5.5)^2$$

........30.25π........cm²

(2)

(Total for question 2 is 4 marks)

3 A rectangular field has a length of 105 metres, to the nearest 5 metres, and a width of 53 metres, to the nearest metre.

(a) Work out the lower bound for the perimeter of the field.

$$100 \quad \uparrow \quad 105 \quad \uparrow \quad 110 \qquad 52 \quad \uparrow \quad 53 \quad \uparrow \quad 54$$
$$102.5 \qquad 107.5 \qquad\qquad 52.5 \qquad 53.5$$

$$2(102.5) + 2(52.5)$$

........310......... m

(2)

(b) Work out the upper bound for the area of the field.

$$107.5 \times 53.5$$

........5751.25........ m²

(2)

(Total for question 3 is 4 marks)

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4 A circle has a radius of 5.36cm, correct to 2 decimal places.

(a) Work out the lower bound for the circumference of the circle.

Give your answer to 2 decimal places.

$$5.35 \quad \uparrow \quad 5.36 \quad \uparrow \quad 5.37$$
$$5.355 \qquad 5.365$$
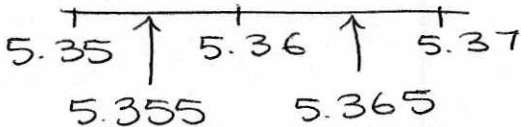
$$2\pi(5.355)$$

........33.65........ cm

(2)

(b) Work out the upper bound for the area of the circle.

Give your answer to 3 significant figures.

$$\pi(5.365)^2$$

........90.4........ cm²
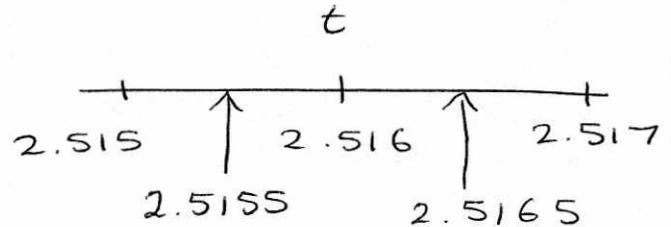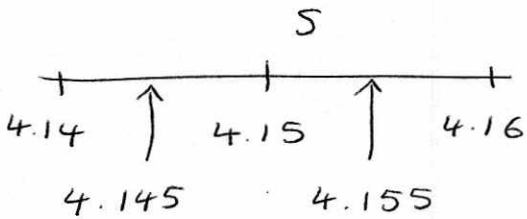
(2)

(Total for question 4 is 4 marks)

5

$$V = \frac{s}{t}$$

$s = 4.15$ correct to 2 decimal places
$t = 2.516$ correct to 3 decimal places

Work out the upper bound for v.

Give your answer to 3 decimal places.

upper $V = \dfrac{\text{upper } s}{\text{lower } t}$

S

4.14 4.15 4.16
4.145   4.155

t

2.515 2.516 2.517
2.5155   2.5165

$$\frac{4.155}{2.5155}$$
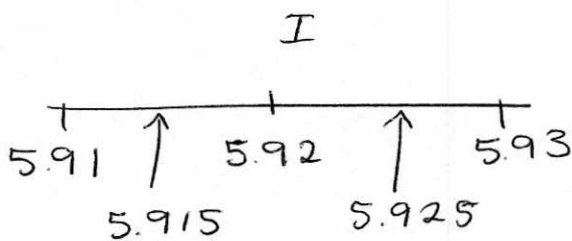
1.652

(Total for question 5 is 3 marks)

6

$$V = IR$$

$I = 5.92$ correct to 2 decimal places
$R = 12.356$ correct to 3 decimal places

Work out the upper bound for V.

Give your answer to 3 decimal places.

upper V = upper I × upper R

I

5.91 5.92 5.93
5.915   5.925
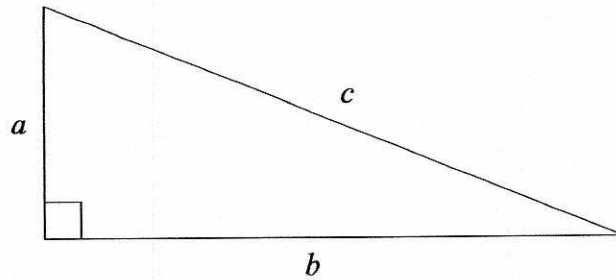
R

12.355 12.356 12.357
12.3555   12.3565
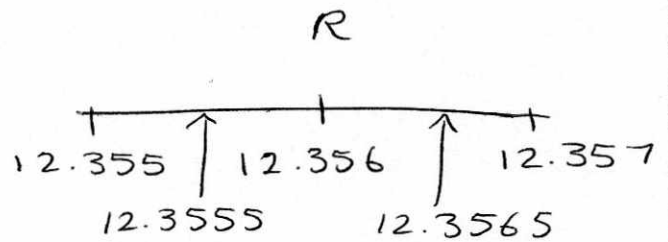
5.925 × 12.3565

73.212

(Total for question 6 is 3 marks)

7

a = 5.3 cm correct to the nearest mm
b = 8.2 cm correct to the nearest mm

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

Calculate the lower bound for c.
You must show all your working.
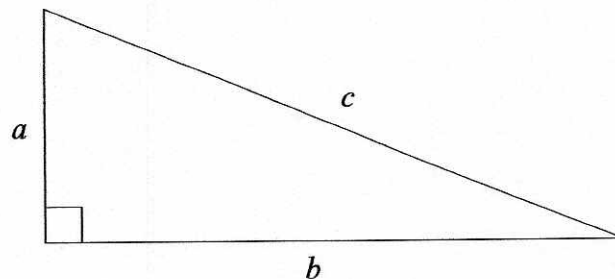
Give your answer to 3 significant figures.

a

5.2 ↑ 5.3 ↑ 5.4   8.1 ↑ 8.2 ↑ 8.3
    5.25   5.35   8.15   8.25

b

$$\sqrt{(5.25)^2 + (8.15)^2}$$

...........9.69...........cm

(Total for question 7 is 4 marks)

8

a = 4.1 cm correct to the nearest mm
c = 10 cm correct to the nearest cm

$$b^2 = c^2 - a^2$$
$$(lower\ b)^2 = (lower\ c)^2 - (upper\ a)^2$$

Calculate the lower bound for b.
You must show all your working.

Give your answer to 1 decimal place.

a   c

4.0 ↑ 4.1 ↑ 4.2   9 ↑ 10 ↑ 11
    4.05   4.15   9.5   10.5

$$\sqrt{(9.5)^2 - (4.15)^2}$$

...........8.5...........cm

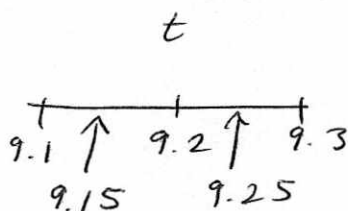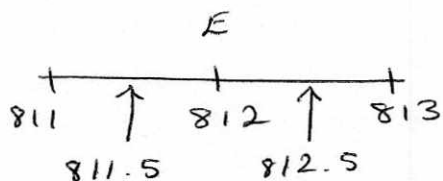**(Total for question 8 is 4 marks)**

9

$$P = \frac{E}{t}$$

$E = 812$ correct to 3 significant figures
$T = 9.2$ correct to 1 decimal place

By considering bounds, work out the value of P to a suitable degree of accuracy.
Give a reason for your answer.

E

811 ↑ 812 ↑ 813
   811.5   812.5

t

9.1 ↑ 9.2 ↑ 9.3
   9.15   9.25

upper P = $\frac{\text{upper } E}{\text{lower } t}$

$= \frac{812.5}{9.15}$

$= 88.79781421$

lower P = $\frac{\text{lower } E}{\text{upper } t}$

$= \frac{811.5}{9.25}$

$= 87.72972973$

Both round to 90 (1sf)

90

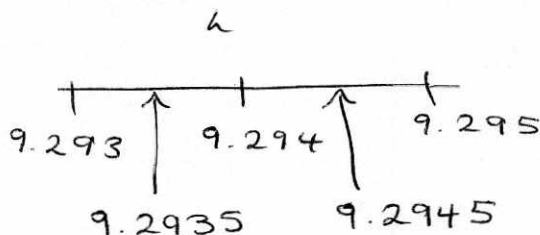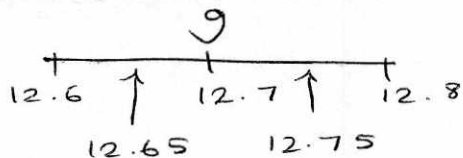**(Total for question 9 is 5 marks)**

10

$$f = \frac{\sqrt{g}}{h}$$

$g = 12.7$ correct to 3 significant figures
$h = 9.294$ correct to 3 decimal places

By considering bounds, work out the value of f to a suitable degree of accuracy.
Give a reason for your answer.

g

12.6 ↑ 12.7 ↑ 12.8
   12.65   12.75

h

9.293 ↑ 9.294 ↑ 9.295
     9.2935   9.2945

upper f = $\frac{\sqrt{\text{upper } g}}{\text{lower } h}$

$= \frac{\sqrt{12.75}}{9.2935}$

$= 0.3842163037$

upper lower f = $\frac{\sqrt{\text{lower } g}}{\text{upper } h}$

$= \frac{\sqrt{12.65}}{9.2945}$

$= 0.3826654231$

Both round to 0.38 (2dp / 2sf)

0.38

(Total for question 10 is 5 marks)

11

$F = 25.14$ N correct to 2 decimal places
$A = 4.29$ m² correct to 3 significant figures
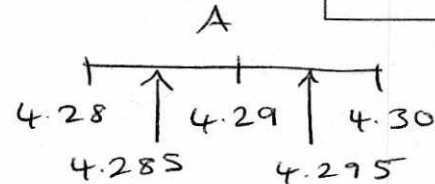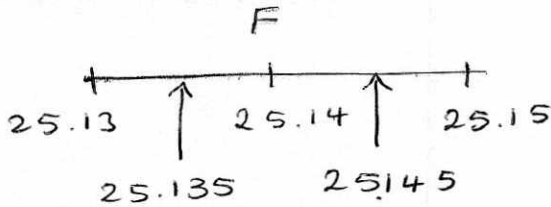
$$p = \frac{F}{A}$$

p = pressure
F = force
A = area

By considering bounds, work out the value of p to a suitable degree of accuracy.
Give a reason for your answer.

F

25.13 ↑ 25.14 ↑ 25.15

25.135   25.145

A

4.28 ↑ 4.29 ↑ 4.30

4.285   4.295

upper P = $\frac{upper\ F}{lower\ A}$

= $\frac{25.145}{4.285}$

= 5.868144691

lower P = $\frac{lower\ F}{upper\ A}$

= $\frac{25.135}{4.295}$

= 5.852153667

Both round to 5.9 (2sf / 1dp)

........5.9........Nm⁻²

(Total for question 11 is 3 marks)

12

$F = 20.81$ N correct to 2 decimal places
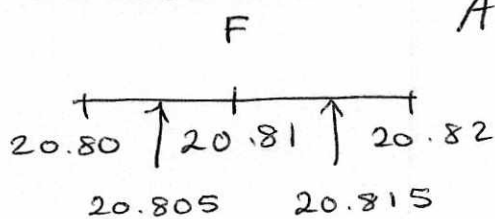$P = 5.12$ Nm⁻² correct to 3 significant figures
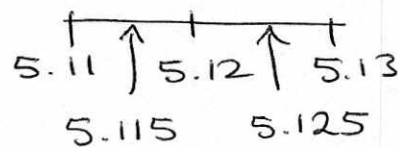
$$p = \frac{F}{A}$$

p = pressure
F = force
A = area

By considering bounds, work out the value of A to a suitable degree of accuracy.
Give a reason for your answer.

$A = \frac{F}{P}$

F

20.80 ↑ 20.81 ↑ 20.82

20.805   20.815

P

5.11 ↑ 5.12 ↑ 5.13

5.115   5.125

upper A = $\frac{20.815}{5.115}$

= 4.069403715

lower A = $\frac{20.805}{5.125}$

= 4.059512195

Both round to 4.1 (2sf / 1dp)

........4.1........m²

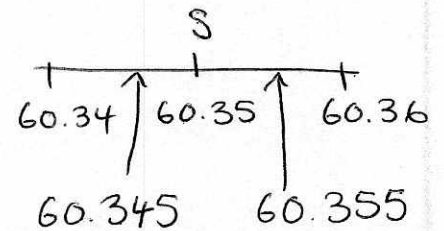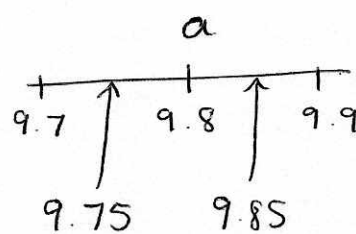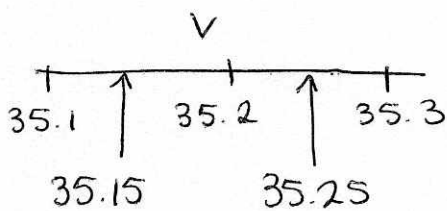**(Total for question 12 is 3 marks)**

13

$$v^2 = u^2 + 2as$$

$v = 35.2$ correct to 1 decimal place
$a = 9.8$ correct to 1 decimal place
$s = 60.35$ correct to 2 decimal places

Work out the upper bound for u.
Give your answer to 3 significant figures.

$$v^2 - 2as = u^2$$

$$\sqrt{v^2 - 2as} = u$$

$$\text{upper } u = \sqrt{(\text{upper } v)^2 - 2(\text{lower } a)(\text{lower } s)}$$

V

```
  35.1      35.2      35.3
      35.15      35.25
```

a

```
  9.7     9.8     9.9
     9.75   9.85
```

S

```
  60.34  60.35   60.36
      60.345   60.355
```

$$\text{upper } u = \sqrt{(35.25)^2 - 2(9.75)(60.345)}$$

$$= 8.113877002$$

$$= 8.11 \ (3sf)$$

................8.11................

(Total for question 13 is 5 marks)