Name: SOLUTIONS

Upper and Lower Bounds

Date:

Time:

Total marks available:

Total marks achieved: _____

Questions

Q1.

Sasha drops a ball from a height of *d* metres onto the ground.

The time, *t* seconds, that the ball takes to reach the ground is given by

$$t = \sqrt{\frac{2d}{g}}$$

where g m/s^2 is the acceleration due to gravity.

d = 35.6 correct to 3 significant figures.
g = 9.8 correct to 2 significant figures.

(a) Write down the lower bound of *d*.

35.55

(1)

(b) Calculate the lower bound of *t*.
You must show all your working.

$$\text{lower } t = \sqrt{\frac{2 \times \text{lower } d}{\text{upper } g}}$$

$$= \sqrt{\frac{2 \times 35.55}{9.85}}$$

2.69 to 3 s.f.

(3)

(Total for Question is 4 marks)

Q2.

Jarek uses the formula

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

to work out the area of a triangle.

For this triangle,

a = 7.8 cm correct to the nearest mm.
b = 5.2 cm correct to the nearest mm.
C = 63° correct to the nearest degree.

Calculate the lower bound for the area of the triangle.

17.7 ..... cm^2
to 3 s.f.

Lower Area
$= \frac{1}{2} \times$ lower $a \times$ lower $b \times \sin$(lower C)
$= \frac{1}{2} \times 7.75 \times 5.15 \times \sin 62.5°$
$=$

(Total for question = 3 marks)

Lower I $= \frac{\text{Lower } V}{\text{Upper } R} = \frac{247.5}{3950}$

Q3.

$I = \frac{V}{R}$

$= 0.062658$

V = 250 correct to the nearest 5

R = 3900 correct to the nearest 100

Work out the lower bound for the value of I.
Give your answer correct to 3 decimal places.
You must show your working.

0.063 to 3 d.p.
.....

(Total for question = 3 marks)

upper bound for $\frac{a}{b}$

$= \frac{\text{upper } a}{\text{lower } b} = \frac{45}{0.15}$

Q4.

a = 40 correct to 1 significant figure.
b = 0.2 correct to 1 significant figure.

Calculate the upper bound of $\frac{a}{b}$

300
.....

Speed = Distance / Time

(Total for question = 3 marks)

lower speed = lower distance / upper time = 232.5 / (202.5 ÷ 60)

= 68.889 mph

Q5.

Steve travelled from Ashton to Barnfield.

He travelled 235 miles, correct to the nearest 5 miles.
The journey took him 200 minutes, correct to the nearest 5 minutes.

Calculate the lower bound for the average speed of the journey.
Give your answer in **miles per hour**, correct to 3 significant figures.
You must show all your working.

68.9 to 3 s.f.

..... mph

(Total for question = 4 marks)

Q6.

The value of p is 4.3
The value of q is 0.4

Both p and q are given correct to the nearest 0.1

(a) Write down the lower bound for p.

4.25

.....

(1)

$$r = p + \frac{1}{q}$$

upper r = upper p + 1 / lower q

= 4.35 + 1 / 0.35

7.21 to 3 s.f.

.....

(b) Work out the upper bound for r.
You must show all your working.

(3)

(Total for question = 4 marks)

Q7.

$$a = \frac{v - u}{t}$$

v = 37.6 correct to 3 significant figures.
u = 11.3 correct to 3 significant figures.
t = 8.4 correct to 2 significant figures.

Work out the upper bound for the value of a.
Show your working clearly.

3.16

.....

(Total for question = 3 marks)

$$\text{upper } a = \frac{\text{upper } v - \text{lower } u}{\text{lower } t}$$

$$= \frac{37.65 - 11.25}{8.35}$$

$$= 3.16 \text{ to } 3 \text{ s.f.}$$