Banker Questions 1

1. Evaluate

$$7.18 - 2.1 \times 3$$ **2 KU**

Multiplication first: 2.1 x 3 = 6.3

Then subtraction:

$$\begin{array}{r} 7.18 \\ -\ 6.30 \\ \hline \mathbf{0.88} \end{array}$$

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2. Evaluate

$$1\tfrac{1}{8} \div \tfrac{3}{4}$$ **2 KU**

Change mixed number to improper fraction.
Flip the second fraction and change sign to multiply
Cancel – then multiply tops, multiply bottoms and put final answer into mixed number.

$$\frac{9}{8} \div \frac{3}{4} \rightarrow \frac{9}{8} \times \frac{4}{3} \rightarrow \frac{\cancel{9}^{3}}{\cancel{8}^{2}} \times \frac{\cancel{4}^{1}}{\cancel{3}^{1}} \rightarrow \frac{3}{2} \rightarrow 1\frac{1}{2}$$

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3. Solve the inequality

$$5 - x > 2(x + 1)$$ **3 KU**

Break the bracket.
Treat exactly the same as you would for an equation – but keep the inequality sign.

$$\begin{aligned} 5 - x &> 2(x+1) \\ 5 - x &> 2x + 2 \\ 5 - 2 &> 2x + x \\ 3 &> 3x \\ 1 &> x \\ x &< 1 \end{aligned}$$

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4. $f(x) = x^2 + 5x$, evaluate $f(-3)$ **2 KU**

Replace x with -3 in the function

$$\begin{aligned} f(x) &= x^2 + 5x \\ f(-3) &= (-3)^2 + 5(-3) \\ f(-3) &= 9 - 15 \\ f(-3) &= -6 \end{aligned}$$

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5. *(a)* Factorise $p^2 - 4q^2$ **1 KU**

Difference of two squares:

$$p^2 - 4q^2$$
$$p^2 - (2q)^2$$
$$(p + 2q)(p - 2q)$$

(b) Hence simplify

$$\frac{p^2 - 4q^2}{3p + 6q}$$ **2 KU**

Note that the top is the same as part (a), so the first part gives us a clue.

The denominator has a common factor of 3.

$$\frac{p^2 - 4q^2}{3p + 6q}$$
$$\frac{(p + 2q)(p - 2q)}{3(p + 2q)}$$
$$\frac{\cancel{(p + 2q)}^{1}(p - 2q)}{3\cancel{(p + 2q)}^{1}}$$
$$\frac{p - 2q}{3}$$

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6. $L = \frac{1}{2}(h - t)$

Change the subject of the formula to h **2 KU**

First step – get rid of the fraction by multiplying throughout by 2.

Then re-arrange the equation to obtain: h = …..

$$L = \frac{1}{2}(h - t)$$
$$2L = h - t$$
$$2L + t = h$$
$$h = 2L + t$$

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7. In 1999, a house was valued at £90,000 and the contents were valued at £60,000.

The value of the house **appreciates** by 5% each year.

The value of the contents **depreciates** by 8% each year.

What will be the **total** value of the house **and** contents in 2002 ? **3 KU**

The house increases in value by 5% per year.

i.e. at end of first year it is worth 100% + 5% = 105% - so multiplier is 105 ÷ 100 = 1.05

So after 3 years (2002 – 1999) the house is worth $90{,}000 \times 1.05^3 = £104{,}186.25$

The contents decrease in value by 8% per year.

i.e. at end of first year they are worth 100% - 8% = 92%

- so multiplier is 92 ÷ 100 = 0.92

So after 3 years (2002 – 1999) the contents are worth $60{,}000 \times 0.92^3 = £46{,}721.28$

So total value in 2002 of house and contents is: £104,186.25 + £46,721.28 = **£150,907.53**

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8. A microwave oven is sold for £150.
This price includes VAT at 17.5%
Calculate the price of the microwave oven without VAT. **3 KU**

If the original price of microwave is 100%,

Then the price of the microwave with VAT is now worth 117.5%

So, 117.5% = £150

1% = £150 ÷ 117.5

100% = £150 ÷ 117.5 × 100 = **£127.66**

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9. How many chocpops will be eaten in the year 2012.

Give your answer in **scientific notation** **2 KU**

2012 is a leap year, so 366 days.

Number of chocpops eaten in 2012 = 10,000 × 60 × 24 × 366 = 5,270,400,000

Per hour per day per year

In scientific notation this is: $\mathbf{5.27 \times 10^9}$

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10. To make "14 carat" gold, copper and pure gold are mixed in the ratio 5:7.
A jeweler has 160 grams of copper and 245 grams of pure gold.
What is the maximum weight of "14 carat" gold that the jeweler can make? **3 RE**

Copper	:	Pure gold	
5	:	7	
		245	× 35

If he uses all the pure gold (245 gm) then he needs to scale the original ratio
Up by $245 \div 7 = 35$ times, so he will need 5×35 gm of copper = 175 gm of copper.
He does not have enough copper for this, so he will have to use all his copper instead.

	Copper	:	Pure gold
	5	:	7
× 32	160		

If he uses all the copper (160 gm) then he needs to scale the original ratio
Up by $160 \div 5 = 32$ times, so he will need 7×32 gm of pure gold = 224 gm of pure gold.
He has sufficient gold for this, so the total weight of ingredients he can use is:

160 gm Copper + 224 gm pure gold = **384 gm of 14 carat gold**

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11. The electrical resistance, R, of copper wire varies directly as its length, L metres, and inversely as the square of its diameter, d millimetres .

Two lengths of copper wire, A and B, have the same resistance.

Wire A has a diameter of 2 millimetres and a length of 3 metres.
Wire B has a diameter of 3 millimetres

What is the length of wire B. **4 RE**

First write down the proportionalities: $R \propto L$ *and* $R \propto \frac{1}{d^2}$ $\rightarrow$ $R = \frac{kL}{d^2}$

For wire A: $R_A = \frac{k \times 3}{2^2}$ and for wire B $R_B = \frac{k \times L}{3^2}$

We are told that the wires have the same resistance, so (*putting wire B first for convenience*):

$\frac{k \times L}{3^2} = \frac{k \times 3}{2^2} \rightarrow \frac{k \times L}{9} = \frac{k \times 3}{4} \rightarrow 4kL = 27k$ Cancel k from each side.

$4L = 27 \rightarrow L = \frac{27}{4}$ so **Length of wire B = 6.75 metres**

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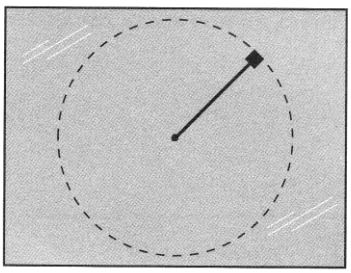
12. A weight on the end of a string is spun in a circle on a smooth table.



The tension, T, in the string varies directly as the square of the speed, v, and inversely as the radius, r, of the circle.

(a) Write down a formula for T in terms of v and r. **1 KU**

(b) The speed of the weight is multiplied by 3 and the radius of the string is halved.

What happens to the tension in the string. **2 RE**

a) First write down the proportionalities: $T \propto v^2$ *and* $T \propto \frac{1}{r}$ $\rightarrow$ $T = \frac{kv^2}{r}$

b) If the speed is multiplied by 3, then Tension will increase by 3×3

(because v is squared)

If the radius of the string is halved, then Tension will increase by 2

(because dividing by ½ is the same as multiplying by 2)

So, overall effect is Tension will increase by $3 \times 3 \times 2$ **= 18 times**

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13. John's school sells 1200 tickets for a raffle.
John buys 15 tickets.

John's church sells 1800 tickets for a raffle.
John buys 20 tickets.

In which raffle has he a better chance of winning the first prize ? **3 RE**
Show clearly all your working.

In school raffle P(win) = $\frac{15}{1200}$ In church raffle P(win) = $\frac{20}{1800}$

Change these to a common denominator to make comparison easy:

School raffle P(win) = $\frac{45}{3600}$ In church raffle P(win) = $\frac{40}{3600}$

So he has a better change of winning in the school raffle by $\frac{5}{3600}$

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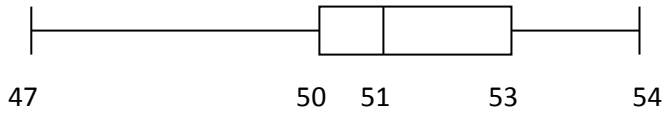
14. A random check is carried out on the contents of a number of matchboxes.
A summary of the results is shown in the boxplot below.



What percentage of matchboxes contains fewer than 50 matches. **1 RE**

By definition 50% of the data lies below median and 50% above median.

Similarly 25% of data lies below lower quartile and 25% between lower quartile and median:

So**:** **25% of matchboxes** contain fewer than 50 matches.

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15. In a class, 30 pupils sat a test.
The marks are illustrated by the stem and leaf diagram below.

Test Marks

0	9
1	6 6 7 8
2	0 4 5 7 9 9 9
3	2 2 3 5 5 6 8
4	0 2 3 4 5 5 7 7 8
5	0 0

n = 30 1 | 6 = 16

(a) Write down the median and the modal mark. **2 KU**

The median mark is the one in the middle when data is in order.

There are 30 data items: So, middle item has 15 data omn either side.

Median lies between 15th and 16th data item: i.e. between 33 and 35.

So **median is 34**.

Modal mark is one which occurs most frequently, this is 29 (there are 3 of them)

So **modal mark is 29**.

(b) Find the probability that a pupil selected at random scored **at least** 40 marks. **1 KU**

Number of pupils scoring at least 40 marks = 11 (since this includes 40)

There are 30 pupils altogether.

So **P(pupil scores at least 40)** = $\frac{11}{40}$

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16. The average monthly temperature in a holiday resort was recorded in degrees Celsius (°C).

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Average Temperature (°C)	1	8	8	10	15	22	23	24	20	14	9	4

Draw a suitable statistical diagram to illustrate the median and the quartiles of this data. **4 RE**

A suitable statistical diagram would be a box plot.

First put the data in order: 1, 4, 8, 8, 9, 10, 14, 15, 20, 22, 23, 24

(Check you have 12 data items)

Median is between 6th and 7th: i.e. between 10 and 14, so median = 12

Lower quartile is in middle of lower half of distribution between 3rd and 4th item:

i.e. between 8 and 8, so LQ = 8

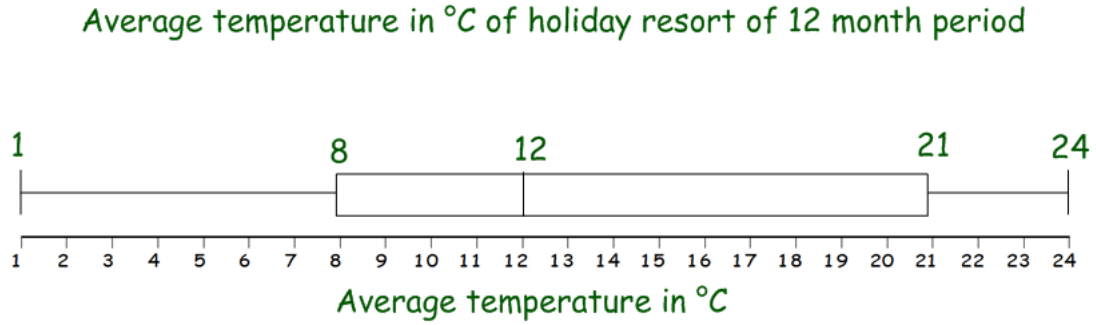
Upper quartile is in middle of upper half of distribution between 9th and 10th item:

i.e. between 20 and 22, so UQ = 21

Lowest data is 1 and Highest data is 24.

Five figure summary is: **Lo = 1; LQ = 8; Median = 12; UQ = 21; Hi = 24**

Now draw box plot – remember uniform scale – label axis, title – use a ruler.



17. Bottles of juice should contain 50 millilitres.
The contents of 7 bottles are checked in a random sample.
The actual volume in millilitres are as shown below:

52, 50, 51, 49, 52, 53, 50

Calculate the mean and standard deviation of the sample. **4 KU**

First calculate mean: Sum of data is: 357

Mean = $\bar{x} = \frac{\sum x}{n} = \frac{357}{7} = 51$

Now draw and complete table for standard deviation.

x	$x - \bar{x}$	$(x - \bar{x})^2$
52	1	1
50	-1	1
51	0	0
49	-2	4
52	1	1
53	2	4
50	-1	1
		12

Use formula:

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$$

Substitute value:

$$s = \sqrt{\frac{12}{7-1}} = \sqrt{\frac{12}{6}} = \sqrt{2}$$

s = 1.414….

Mean of sample = 51 ml and standard deviation is 1.4 ml.

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18. A garage carried out a survey on 600 cars.
The results are shown in the table below:

Engine size (cc)

Age		0 – 1000	1001 – 1500	1501 – 2000	2001 +
	Less than 3 years	50	80	160	20
	3 years or more	60	100	120	10

(a) What is the probability that a car chosen at random, is less than 3 years old? **1**

(b) In a sample of 4200 cars, how many would be expected to have an engine size greater than 2000cc and be 3 or more years old. **2**

(a) No of cars < 3 yrs old = top row = 50 + 80 + 160 + 20 = 310 Total number of cars = 600

So, P(< 3yrs old) = $\frac{310}{600} = \frac{31}{60}$

(b) From survey, engine size > 2000 cc AND 3 or more years old = 10

So P(>2000cc and ≥ 3yrs) = $\frac{10}{600} = \frac{1}{60}$ Expected number would be same fraction of 4200.

Expected number of 4200 cars (>2000cc and ≥ 3yrs) = $\frac{1}{60} \times 4200 = 70$ *cars*

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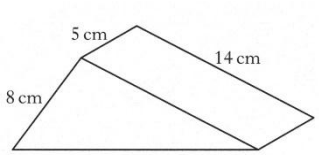
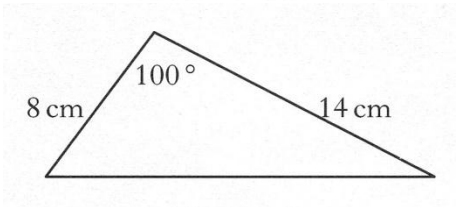
19. A metal doorstop is prism shaped, as shown in Figure 1

Figure 1.



The uniform cross-section as shown in Figure 2:

Figure 2.



Find the volume of metal required to make the doorstop. **4 KU**

Volume = AL (Area of cross section × length)

Area of cross section = ½ a b sin C = ½ × 8 × 14 × sin 100 = 55.149… = 55.15 cm^2

Hence volume of metal required = 55.15 × 5 = 275.75 cm^3 = 275.8 cm^3

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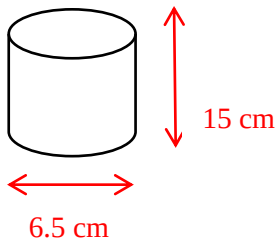
20. A cylindrical soft drinks can is 15 centimetres in height and 6.5 centimetres in diameter.

A new cylindrical can holds the same volume but has a reduced height of 12 centimetres.

What is the diameter of the new can ?

Give your answer to 1 decimal place. **4 RE**

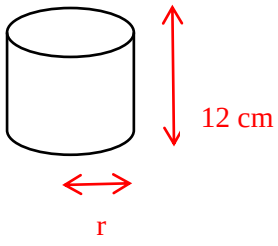


Volume of cylinder = $\pi r^2 h = \pi \times 3.25^2 \times 15$

Note that radius is half diameter i.e. 6.5 ÷ 2 = 3.25 cm

Volume of can = 158.4375 π cm^3

Note that we can leave π in here as it will cancel out later.



Let radius of new can be r.

Volume of cylinder = $\pi r^2 h = \pi \times r^2 \times 12 = 12 \pi r^2$

However this is same as volume of old can, so

$12 \pi r^2 = 158.4375 \pi$ cancelling π, we see that

$12 r^2 = 158.4375$ and so

$$r^2 = \frac{158.4375}{12} = 13.203... \rightarrow r = 3.6336.... \ cm$$

So radius of new can is: **3.6 cm** (to one decimal place)

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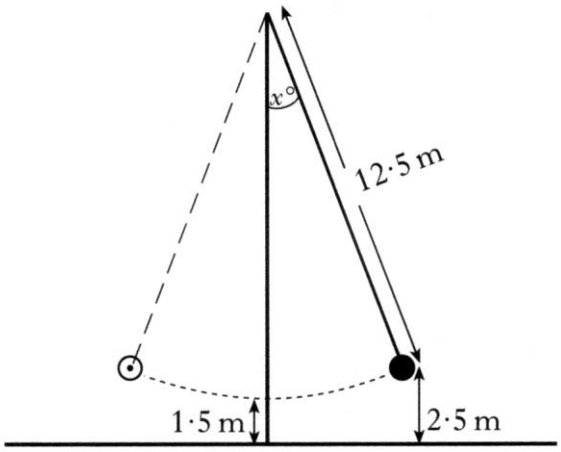
21. The chain of a demolition ball is 12.5 metres long.
When vertical, the end of the chain is 1.5 metres from the ground.

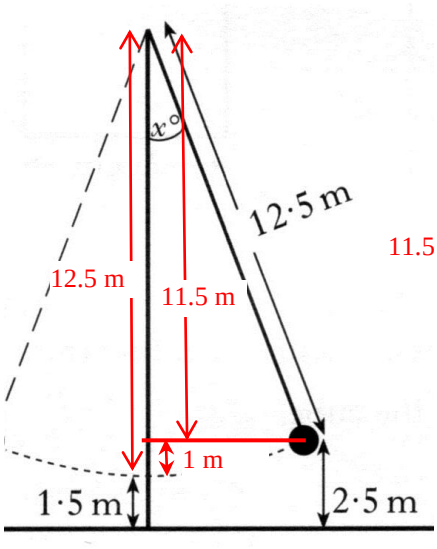


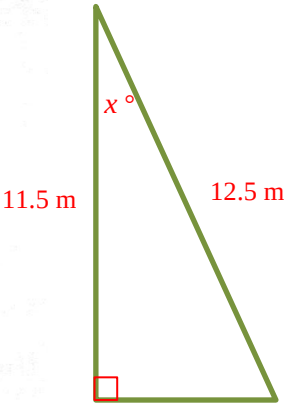
It swings to a maximum height of 2.5 metres above the ground on both sides.

(a) At this maximum height, show that the angle x°, which the chain makes with the vertical, is approximately 23° 4

(b) Calculate the maximum length of the arc through which the end of the chain swings. Give your answer to 3 significant figures. 4

First draw a suitable diagram that you can mark information on.





a)

$$\cos x = \frac{11.5}{12.5} \rightarrow x = \cos^{-1}\left(\frac{11.5}{12.5}\right) = 23.0739...°$$

which is approximately 23°

b) Round x to 23.07 (4 sig figs)

Sector angle = $2x$ = 46.14°

Maximum arc length is when sector angle = 46.14°

$$\frac{\text{arc length}}{\text{circumference}} = \frac{\text{sector angle}}{360°}$$

$$\text{arc length} = \frac{\text{sector angle}}{360°} \times \text{circumference} \rightarrow \text{arc length} = \frac{46.14}{360} \times \pi \times 2 \times 12.5$$

Hence maximum arc length = 10.06618….. = **10.1 metres**