

SOLUTIONS to: Non-calculator Questions

1. Evaluate
- $8.1 - 19.4 \div 4$

$$\text{Division first: } \begin{array}{r} 4.85 \\ 4 \overline{) 19.40} \end{array} \quad \text{then subtraction (BODMAS)} \quad \begin{array}{r} 8.10 \\ - 4.85 \\ \hline 3.25 \end{array}$$

2. Evaluate
- $5.7 + 3.9 \times 4$
-
- Use BODMAS, multiply first, then add.

$$\begin{array}{r} 3.9 \\ \times 4 \\ \hline 15.6 \end{array} \quad \begin{array}{r} 15.6 \\ + 5.7 \\ \hline 21.3 \end{array}$$

3. Evaluate 35% of £850

Find 10% is 85, and 5% is half of 10% which is 42.5

So for 35% we want 3 lots of 10% and 1 lot of 5%.

i.e. $85 \times 3 = 255$ plus 42.5 which is $297.5 = \text{£}297.50$

4. Find
- $\frac{3}{8}$
- of 544

First find one eighth, and then multiply by 3. $544 \div 8 = 68$, then $\times 3 = 204$

- 5.
- $f(x) = x^2 - 2x$
- , evaluate
- $f(-2)$

Replace every occurrence of x with -2 Hence: $f(-2) = (-2)^2 - 2(-2) = 4 + 4 = 8$

- 6.
- $f(x) = 9 - 6x$

(a) Evaluate $f(-3)$ As above: $f(-3) = 9 - 6(-3) = 9 + 18 = 27$ (b) Given that $f(t) = 11$, find t First find expression for $f(t)$

$f(t) = 9 - 6t$ You know $f(t) = 11$, so replace it: $11 = 9 - 6t$

Now solve equation for t : $11 = 9 - 6t \rightarrow 2 = -6t \rightarrow -2 = 6t \rightarrow t = -\frac{1}{3}$

7. Factorise
- $6x^2 - 9x$
- This is a common factor:
- $3x(2x - 3)$
- (check by multiplying out)

8. Factorise
- $4a^2 - 9b^2$
- This is difference of two squares:

$4a^2 - 9b^2 \rightarrow (2a)^2 - (3b)^2 \rightarrow (2a + 3b)(2a - 3b)$ (check by multiplying out)

9. Factorise
- $3x^2 - 13x - 10$
- This is a trinomial – put into two brackets

$3x^2 - 13x - 10 \rightarrow (3x + 2)(x - 5)$ (check by multiplying out)

10. Express $\frac{15x-20}{9x^2-16}$ in its simplest form

Factorise top as common factor

Factorise bottom as difference of two squares, then cancel.

$$\frac{15x-20}{9x^2-16} \rightarrow \frac{5(3x-4)}{(3x+4)(3x-4)} \rightarrow \frac{5\cancel{(3x-4)}}{(3x+4)\cancel{(3x-4)}} \rightarrow \frac{5}{(3x+4)}$$

11. Remove the brackets and collect like terms $(3a-b)(2a-5b)$

Use FOIL: $(3a-b)(2a-5b) \rightarrow 6a^2 - 15ab - 2ab + 5b^2 \rightarrow 6a^2 - 17ab + 5b^2$

12. Simplify $4(3x-2) - 5(4x+1)$

Multiply out brackets: $4(3x-2) - 5(4x+1) \rightarrow 12x - 8 - 20x - 5 \rightarrow -8x - 13$

13. Remove the brackets and simplify $(3y-4)^2$

Write this out in full and use FOIL:

$$(3y-4)^2 \rightarrow (3y-4)(3y-4) \rightarrow 9y^2 - 12y - 12y + 16 \rightarrow 9y^2 - 24y + 16$$

14. Change the subject of the formulae

a) $Y = \frac{3(2v-w)}{5}$ Change the subject of the formula to v .

Get rid of the fraction, (*multiply both sides by 5*)

break the bracket and re-arrange:

$$Y = \frac{3(2v-w)}{5} \rightarrow 5Y = 3(2v-w) \rightarrow 5Y = 6v - 3w$$

$$\rightarrow 5Y + 3w = 6v \rightarrow v = \frac{5Y + 3w}{6}$$

b) $P = \frac{1}{3}(m-s)$ Change the subject of the formula to m

Get rid of the fraction, remove the bracket and re-arrange:

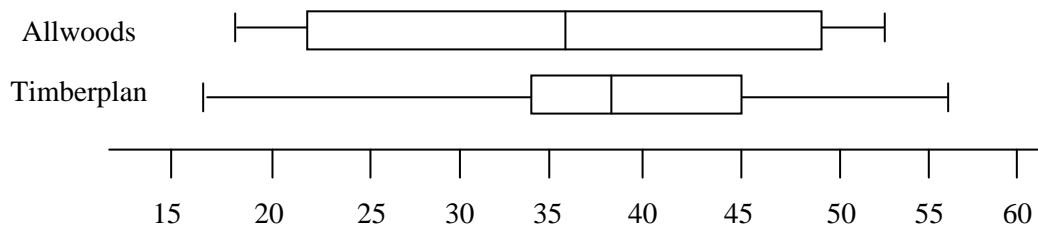
$$P = \frac{1}{3}(m-s) \rightarrow 3P = m-s \rightarrow 3P + s = m \rightarrow m = 3P + s$$

15. A furniture maker investigates the delivery times, in days, of two local wood companies and obtains the following data.

<i>Company</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Lower Quartile</i>	<i>Median</i>	<i>Upper Quartile</i>
Timberplan	16	56	34	38	45
Allwoods	18	53	22	36	49

- a) Draw an appropriate statistical diagram to illustrate these two sets of data.
 b) Given that consistency of delivery is the most important factor, which company should the furniture maker use? Give a reason for your answer.

From the data given – lower and upper quartiles and median, a boxplot would be appropriate.



Timberplan is more consistent, the interquartile range is smaller.
 50% of the delivery times are between 34 and 45 days

16. Jamie conducted a survey.
 He asked his classmates how they had travelled to school that day.

Here are their replies.

Walk	13
Bus	9
Car	6
Cycle	2

Draw an appropriate statistical diagram to illustrate this information

A pie chart is an appropriate statistical diagram. Draw a table and calculate the angles:

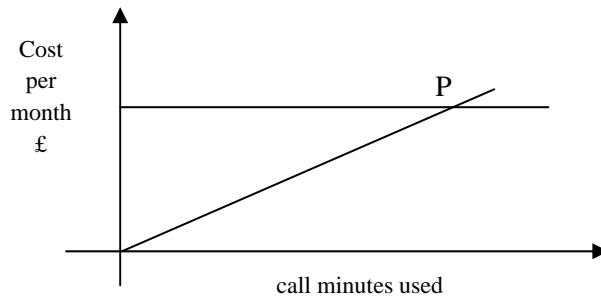
	Freq.	Angle calculation	Angle
Walk	13	$\frac{13}{30} \times 360$	156°
Bus	9	$\frac{9}{30} \times 360$	108°
Car	6	$\frac{6}{30} \times 360$	72°
Cycle	2	$\frac{2}{30} \times 360$	24°
Total	30		360°

Draw a pie chart with these angles.

Label each sector

Give the pie chart a title

17. A mobile phone company is offering two charging plans.



- a) All-in calls and texts £25 per month.
b) No monthly rental and 10p per minute for calls

Write down the coordinates of P.

The y-coordinate of P is the flat rate. £ 25

The x-coordinate of P is the number of minutes where the call charges equal the flat rate of £ 25

i.e. the number of 10p call minutes equal to £ 25.

You need 250 calls at 10p each to make £25

Hence: P is P(250, 25)

18. When microprocessors are made, it is known that in any batch, 15% are defective.

- a) What is the probability of picking a microprocessor that is **NOT** defective
b) A batch of 5000 microprocessors are produced. How many would be expected to have **NO** defects.

a) $P(\text{microprocessor is NOT defective}) = 1 - 0.15 = 0.85$

- b) For a batch of 5000, 85% would have no defects

$$\rightarrow \frac{85}{100} \times 5000 = 85 \times 50 = 850 \times 5 = 4250$$

19. A box contains **5 red, 6 green, 7 blue and 2 yellow** coloured pencils.

Jenny picks one out of the box

- a) What is the probability that it is a **green pencil**
b) She does **NOT** replace the pencil, but draws another one
What is the probability that this is a blue pencil

a) $P(\text{green}) = \frac{6}{20} = \frac{3}{10}$

- b) Assuming it was green, then there are now only 19 pencils, so: $P(\text{blue}) = \frac{7}{19}$
-

20. MacAdams are offering a special price on the MegaGames Machine XR2.

They are offering it at 30% off the list price.

MacAdams price is: £ 105 . What is the list price ?

If the price is 30% off, then this is 70% of the list price.

So: 70% is £ 105 we can find that 10% is therefore $105 \div 7 = £ 15$

Hence 100% is $£ 15 \times 10 = £ 150$

Alternatively: List Price $\times 0.7 = £105$ So, List price = $\frac{105}{0.7} \rightarrow \frac{1050}{7} \rightarrow £150$

$$\begin{array}{r} 150 \\ 7 \overline{) 1050} \end{array}$$

21. A wooden toy box is prism-shaped

as shown in figure 1.

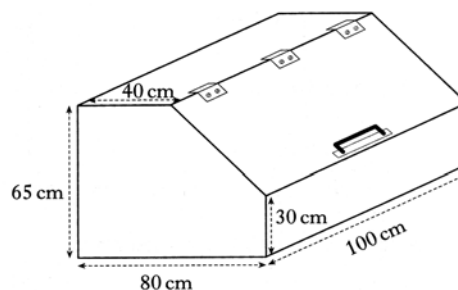


figure 1

The uniform cross-section of the box is as shown in figure 2.

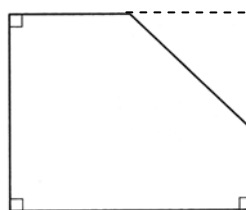


figure 2

Calculate the volume of the box in **cubic metres**.

This is a prism: So the volume is: Area of cross section \times length.

Cross section is a rectangle minus the triangle.

We also need to work in metres.

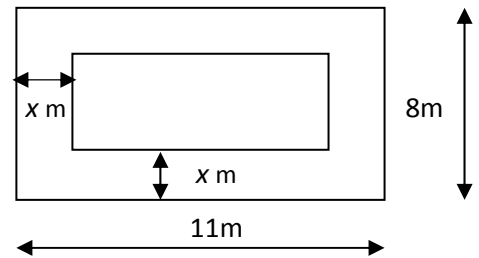
Area of rectangle is: $0.65 \times 0.80 = 0.52 \text{ m}^2$

Area of triangle is: $\frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 0.40 \times 0.35 = 0.20 \times 0.35 = 0.07 \text{ m}^2$

Area of cross section is: $0.52 - 0.07 = 0.45 \text{ m}^2$. Length is 1m

Hence volume of toy box is: Area of cross section \times length = $0.45 \times 1 = 0.45 \text{ m}^3$

- 22 Alastair McIver is planning his garden. Overall the size is 8m by 11m. He decides to have a lawn with a path around it. The width of the path is x metres.



- i) Show that the area of the lawn is given by:

$$A = 4x^2 - 38x + 88 \text{ m}^2$$

- ii) If Mrs McIver wants the lawn to be 40 m^2 Find a possible value for x .

- i) Length of lawn = $11 - 2x$ breadth of lawn = $8 - 2x$

Area of lawn is: length \times breadth =

$$\rightarrow (11 - 2x)(8 - 2x) \rightarrow 88 - 22x - 16x + 4x^2 \rightarrow 88 - 38x + 4x^2$$

$$\text{Rearrange to get above } A = 4x^2 - 38x + 88$$

- ii) If lawn has to be 40 m^2 then: $4x^2 - 38x + 88 = 40$

Rearrange the equation: $4x^2 - 38x + 48 = 0$ (could divide throughout by 2)

Factorise (two brackets) $(4x - 6)(x - 8) = 0$

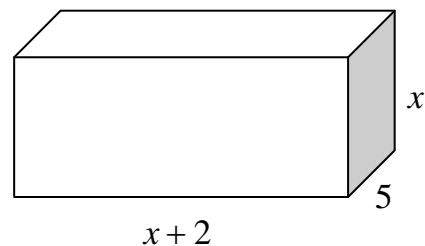
So one or both brackets must be zero: $(4x - 6) = 0$ or $(x - 8) = 0$

$$\text{Hence: } 4x - 6 = 0 \rightarrow 4x = 6 \rightarrow x = 1.5$$

$$\text{or } x - 8 = 0 \rightarrow x = 8$$

Since the breadth of the garden is 8m, then we discard this solution and so the breadth of the path must be 1.5 metres. **Hence $x = 1.5$**

- 23 A container is shown to the right with the dimensions marked in centimetres



- i) Show that the volume of the box is $5x^2 + 10x \text{ cm}^3$

- ii) If the volume of the box is 315 cm^3 Find the value of x and hence find the dimensions of the box.

- i) Volume = length \times breadth \times height:

$$V = (x + 2) \times 5 \times x \rightarrow V = 5x(x + 2) \rightarrow V = 5x^2 + 10x$$

- ii) Given $V = 315$, solve the equation as in previous example.

$$V = 5x^2 + 10x \rightarrow 315 = 5x^2 + 10x \text{ (rearranging)} \rightarrow 5x^2 + 10x - 315 = 0$$

Make it simpler by dividing throughout by 5: $\rightarrow x^2 + 2x - 63 = 0$

Factorise to solve: $\rightarrow x^2 + 2x - 63 = 0 \rightarrow (x + 9)(x - 7) = 0$

$$\text{Hence: } x + 9 = 0 \rightarrow x = -9 \text{ or } x - 7 = 0 \rightarrow x = 7$$

Discard $x = -9$ as you cannot have a negative length. So $x = 7$

Dimensions of box are 9cm long, 5 cm wide and 7 cm high.