

Standard form and Indices

$$a^n \times a^m = a^{n+m}$$

$$a^n \div a^m = a^{n-m}$$

$$(a^n)^m = a^{n \times m}$$

$$a^0 = 1$$

Standard form

$$a \times 10^n$$

$$1 < a < 10$$

<p>A1 Write as a single power of 5</p> $5 \times 5 \times 5 \times 5 \times 5$ 5^6	<p>A2 Write as a single power of 3</p> $3 \times 3^4 \times 3^7$ 3^{12}	<p>A3 Write as a single power of 4</p> $4^5 \times 4^2 \times 4$ 4^8	<p>A4 Write as a single power of 2</p> $2^6 \times 2^4 \times 2^{-3}$ 2^7
<p>B1 Write as a single power of 6</p> $\frac{6^5}{6^3}$ 6^2	<p>B2 Write as a single power of 4</p> $4^8 \div 4^2$ 4^6	<p>B3 Write as a single power of 5</p> $\frac{5^4}{5^7}$ 5^{-3}	<p>B4 Write as a single power of 3</p> $3^{-2} \div 3^5$ 3^{-7}
<p>C1 Find the value of n</p> $\frac{4^n \times 4^5}{4^3} = 4^7$ $n = 5$	<p>C2 Find the value of n</p> $\frac{2^5 \times 2^n}{2^2} = 2^8$ $n = 5$	<p>C3 Find the value of n</p> $\frac{5^3 \times 5^6}{5^n} = 5^5$ $n = 4$	<p>C4 Find the value of n</p> $\frac{7^n \times 7^n}{7^9} = 7^{-3}$ $n = 3$
<p>D1 Write as a single power of 5</p> $(5^4)^3$ 5^{12}	<p>D2 Write as a single power of 7</p> $(7^2)^5$ 7^{10}	<p>D3 Write as a single power of 2</p> $(2^3)^{-2}$ 2^{-6}	<p>D4 Write as a single power of 4</p> $(4^3)^2 \times (4^2)^5$ $4^6 \times 4^{10}$ 4^{16}

A1 Convert 32,567 into standard form 3.2567×10^4	A2 Convert 0.00436 into standard form 4.36×10^{-3}	A3 Write 7 867 030 in standard form. 7.86703×10^6	A4 Write 0.0000512 in standard form 5.12×10^{-5}
B1 Convert 2.37×10^5 into an ordinary number. 237000	B2 Write 7.83×10^{-4} as an ordinary number. 0.000783	B3 Write 5.71×10^7 as an ordinary number. 57100000	B4 Convert 9.28×10^{-6} into an ordinary number. 0.00000928

C1 List in ascending order: 1.4×10^9 1.3×10^9 3.2×10^8 9.7×10^7 1.2×10^8 9.7×10^7 1.2×10^8 1.3×10^9 1.4×10^9	C2 List in descending order: 2.97×10^6 1.25×10^6 4.22×10^5 4.38×10^5 1.59×10^6 2.97×10^6 1.59×10^6 1.25×10^6 4.38×10^5 4.22×10^5	C3 List in ascending order: 1.2×10^{-4} 1.4×10^{-3} 5.0×10^{-4} 6.8×10^{-3} 1.2×10^{-5} 1.2×10^{-5} 5.0×10^{-4} 6.8×10^{-3} 1.4×10^{-3}	C4 List in descending order: 1.4×10^{-3} 1.3×10^4 1.3×10^4 3.2×10^{-4} 9.7×10^3 1.2×10^{-3} 1.2×10^{-3} 1.3×10^4 9.7×10^3 1.2×10^{-3} 3.2×10^{-4}
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D1 Add 7.35×10^4 and 8.21×10^3 Give your answer in standard form	D2 Subtract 3.21×10^6 from 6.14×10^7 Give your answer in standard form	D3 Multiply 6.1×10^3 and 2.2×10^4 Give your answer in standard form	D4 Divide 1.2×10^7 by 4.8×10^2 Give your answer in standard form
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$$\begin{array}{r}
 73500 \\
 + 821000 \\
 \hline
 = 894500
 \end{array}$$

$$\begin{array}{r}
 61400000 \\
 - 3210000 \\
 \hline
 = 58190000
 \end{array}$$

$$1.342 \times 10^8$$

$$2.5 \times 10^4$$

Expanding and Factorising including quadratics

A1 Expand $5(x+6)$ $5x + 30$	A2 Expand $3(x-2)$ $3x - 6$	A3 Expand $7(x+y)$ $7x + 7y$	A4 Expand $4(x+y-3)$ $4x + 4y - 12$
B1 Expand $x(x+5)$ $x^2 + 5x$	B2 Expand $x(x-9)$ $x^2 - 9x$	B3 Expand $x(x+y)$ $x^2 + xy$	B4 Expand $x(x+x^2-y)$ $x^2 + x^3 - xy$
C1 Expand $2x(x+3)$ $2x^2 + 6x$	C2 Expand $3x(2x-7)$ $6x^2 - 21x$	C3 Expand $5x(x-y)$ $5x^2 - 5xy$	C4 Expand $5x(2x-y+3)$ $10x^2 - 5xy + 15x$

A1 Expand and simplify $2(x+3) + 3(x+5)$ $2x + 6 + 3x + 15$ $5x + 21$	A2 Expand and simplify $3(x-4) + 4(x+5)$ $3x - 12 + 4x + 20$ $7x + 8$	A3 Expand and simplify $6(x+4) + 2(x-7)$ $6x + 24 + 2x - 14$ $8x + 10$	A4 Expand and simplify $5(x-2) + 3(x-5)$ $5x - 10 + 3x - 15$ $8x - 25$
B1 Expand and simplify $4(x+6) - 2(x+3)$ $4x + 24 - 2x - 6$ $2x + 18$	B2 Expand and simplify $5(x+2) - 3(x+1)$ $5x + 10 - 3x - 3$ $2x + 7$	B3 Expand and simplify $4(x-3) - 2(x+5)$ $4x - 12 - 2x - 10$ $2x - 22$	B4 Expand and simplify $5(x-2) - 2(x+4)$ $5x - 10 - 2x - 8$ $3x - 18$

A1 Expand $(x+2)(x+4)$ $x^2 + 6x + 8$	A2 Expand $(x-5)(x+7)$ $x^2 + 2x - 35$	A3 Expand $(x+7)^2$ $x^2 + 14x + 49$	A4 Expand $(x-4)(x-5)$ $x^2 - 9x + 20$
B1 Expand $(x+8)(x-3)$ $x^2 + 5x - 24$	B2 Expand $(x-3)(x-2)$ $x^2 - 5x + 6$	B3 Expand $(2x+5)(x-6)$ $2x^2 - 7x - 30$	B4 Expand $(x-5)^2$ $x^2 - 10x + 25$
C1 Expand $(x-8)(x+3)$ $x^2 - 5x - 24$	C2 Expand $(x+1)^2$ $x^2 + 2x + 1$	C3 Expand $(x-8)(x-9)$ $x^2 - 17x + 72$	C4 Expand $(x+8)(x+3)$ $x^2 + 11x + 24$
D1 Expand $(x-4)^2$ $x^2 - 8x + 16$	D2 Expand $(3x-1)(x-8)$ $3x^2 - 25x + 8$	D3 Expand $(x+9)(x-9)$ $x^2 - 81$	D4 Expand $(x-6)(x+6)$ $x^2 - 36$

Factorise these expressions

- a** $3y + 6$ $3(y+2)$ **b** $2x + 2$ $2(x+1)$ **c** $5p - 10$ $5(p-2)$ **d** $3d + 6e$ $3(d+2e)$
e $6x + 2y$ $2(3x+y)$ **f** $3a - 12b$ $3(a-4b)$ **g** $12p - 6q$ $6(2p-q)$ **h** $4d + 6e$ $2(2d+3e)$
i $9d - 6e - 12f$ $3(3d-2e-4f)$ **n** $pq + pr$ $p(q+r)$ **o** $xy + zy$ $y(x+z)$ **p** $ab - 7b$ $b(a-7)$
j $db - b$ $b(d-1)$ **r** $pq + py + pp$ $p(q+y+1)$ **s** $y^2 + yz$ $y(y+z)$ **t** $y^2 + y$ $y(y+1)$
k $4y^2 - 3y$ $y(4y-3)$ **v** $y^3 + 2y$ $y(y^2+2)$ **w** $y^3 - 5y$ $y(y^2-5)$ **x** $p^2 + pq + p$ $p(p+q+1)$
l $ay^3 - by^2 + cy$ $y(ay^2 - by + c)$

Factorise:

1) $x^2 + 6x + 8$

$$(x+2)(x+4)$$

2) $x^2 + 8x + 15$

$$(x+3)(x+5)$$

3) $x^2 + 9x + 20$

$$(x+4)(x+5)$$

4) $x^2 + 8x + 7$

$$(x+1)(x+7)$$

5) $x^2 + 10x + 16$

$$(x+8)(x+2)$$

6) $x^2 + 6x - 7$

$$(x-1)(x+7)$$

7) $x^2 + x - 6$

$$(x-2)(x+3)$$

8) $x^2 + 9x + 20$

$$(x+4)(x+5)$$

9) $x^2 - 2x - 35$

$$(x-7)(x+5)$$

Solving Equations and Inequalities

A1 Solve $2x+5=16$ $2x=11$ $x=5.5$	A2 Solve $3x+2=9$ $3x=7$ $x=\frac{7}{3}$	A3 Solve $5x-9=7$ $5x=16$ $x=\frac{16}{5}$	A4 Solve $7x-10=28$ $7x=38$ $x=\frac{38}{7}$
B1 Solve $2(x+5)=16$ $2x+10=16$ $2x=6$ $x=3$	B2 Solve $3(x+2)=9$ $3x+6=9$ $3x=3$ $x=1$	B3 Solve $5(x-9)=7$ $5x-45=7$ $5x=52$ $x=\frac{52}{5}$	B4 Solve $7(x-10)=28$ $7x-70=28$ $7x=98$ $x=14$
C1 Solve $\frac{x}{3}+7=9$ $\frac{x}{3}=16$ $x=48$	C2 Solve $\frac{x}{5}-3=8$ $\frac{x}{5}=11$ $x=55$	C3 Solve $\frac{x}{7}+11=15$ $\frac{x}{7}=4$ $x=28$	C4 Solve $\frac{x}{4}-9=13$ $\frac{x}{4}=22$ $x=88$
D1 Solve $\frac{x+7}{3}=9$ $x+7=27$ $x=20$	D2 Solve $\frac{x-3}{5}=8$ $x-3=40$ $x=43$	D3 Solve $\frac{x+11}{7}=15$ $x+11=105$ $x=94$	D4 Solve $\frac{x-9}{4}=13$ $x-9=52$ $x=61$

A1 Solve $7x + 5 = 4x + 11$ $3x = 6$ $x = 2$	A2 Solve $5x - 12 = 2x - 9$ $3x = 3$ $x = 1$	A3 Solve $4x + 13 = 8x - 25$ $38x = 12$ $x = \frac{12}{38}$	A4 Solve $6x - 5 = 5x + 1$ $x = 6$
B1 Solve $9(x + 1) = 5x + 16$ $9x + 9 = 5x + 16$ $4x = 7$ $x = \frac{7}{4}$	B2 Solve $3x - 17 = x - 5$ $2x = 12$ $x = 6$	B3 Solve $4x + 3 = 9(x + 2)$ $4x + 3 = 9x + 18$ $-15 = 5x$ $x = -3$	B4 Solve $3x + 16 = 7x - 11$ $27 = 4x$ $x = \frac{27}{4}$
C1 Solve $4(x + 3) = 2(x + 2)$ $4x + 12 = 2x + 4$ $2x = -8$ $x = -4$	C2 Solve $7(x - 5) = 5(x + 3)$ $7x - 35 = 5x + 15$ $2x = 50$ $x = 25$	C3 Solve $5(2x + 1) = 2(6x + 7)$ $10x + 5 = 12x + 14$ $-9x = 2x$ $x = -4.5$	C4 Solve $5(4x + 1) = 3(4x - 3)$ $20x + 5 = 12x - 9$ $8x = -14$ $x = \frac{-14}{8}$

A1 Solve $x + 5 > 11$ $x > 6$	A2 Solve $4x + 11 \leq 29$ $4x \leq 18$ $x \leq \frac{18}{4} \quad (4.5)$
B1 Solve $\frac{2x+5}{3} > 7$ $2x + 5 > 21$ $2x > 16$ $x > 8$	B2 Solve $6x + 3 \leq 2x + 19$ $4x \leq 16$ $x \leq 4$
C1 List the integer values for x if: $-3 \leq x < 4$ $-3, -2, -1, 0, 1, 2, 3$	C2 List the integer values for x if: $-5 \leq 5x \leq 15$ $-1 \leq x \leq 3$ $-1, 0, 1, 2, 3$
D1 Solve $x^2 - 7 < 42$ $x^2 < 49$ $-7 < x < 7$	D2 Solve $3x^2 - 17 < 31$ $3x^2 < 48$ $x^2 < 16$ $-4 < x < 4$



Rearranging Formulae

Make y the subject of the following formulae:

1. $Ay = c$

$$y = \frac{c}{A}$$

2. $y + gb = s$

$$y = s - gb$$

3. $y - h^2 = p$

$$y = p + h^2$$

4. $y + c + r = s$

$$y = s - c - r$$

5. $y + r = 3r$

$$y = 2r$$

Make f the subject of the following formulae:

1. $\sqrt{f} = p$

2. $\sqrt{f} + e = k$

3. $g\sqrt{f} = W$

4. $\sqrt{f + s} = m$

5. $\sqrt{Yf} = Q$

6. $e\sqrt{rf} + N = Z$

7. $\frac{\sqrt{f}}{h} = s$

8. $\sqrt{\frac{f}{h}} = L$

Make k the subject of the following formulae:

1. $5k - t = ry$

$$\begin{aligned} 5k &= ry + t \\ k &= \frac{ry + t}{5} \end{aligned}$$

2. $Pbk - f = a + b$

$$\begin{aligned} Pbk &= a + b + f \\ k &= \frac{a + b + f}{Pb} \end{aligned}$$

3. $2bk + z = 3$

$$\begin{aligned} 2bk &= 3 - z \\ k &= \frac{3 - z}{2b} \end{aligned}$$

4. $(a+b)k - g =$

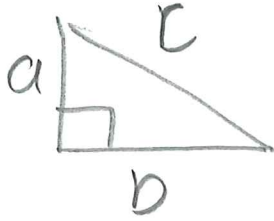
$$k = \frac{g}{(a+b)}$$

5. $k(t-p) = G + D$

$$k = \frac{G + D}{t - p}$$

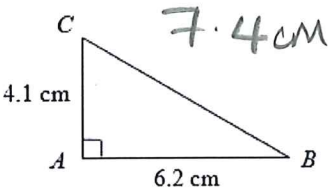
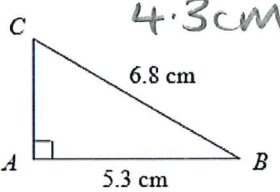
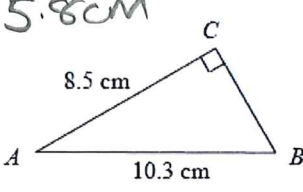
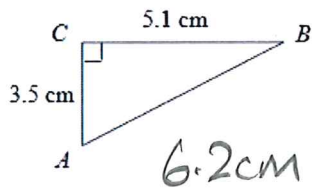
Pythagoras' Theorem and Trigonometry

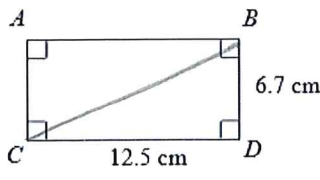
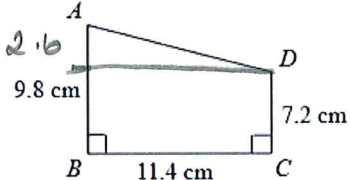
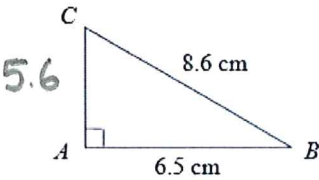
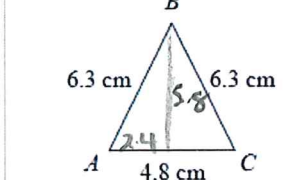
$$a^2 + b^2 = c^2$$



SOH CAH TOA

S^OH C^AH T^OA

<p>A1 Find length BC</p> 	<p>A2 Find length AC</p> 	<p>A3 Find length BC</p> 	<p>A4 Find length AB</p> 
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<p>B1 Find length BC</p> 	<p>B2 Find length AD</p> 	<p>B3 Find the area</p> 	<p>B4 Find the area</p> 
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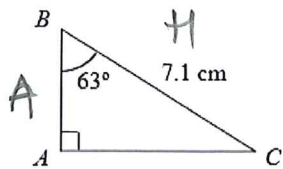
14.2 cm

11.7 cm

$$\frac{5.6 \times 6.5}{2} = 18.2 \text{ cm}^2$$

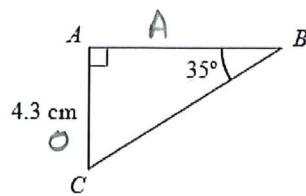
$$\frac{4.8 \times 5.8}{2} = 13.92 \text{ cm}^2$$

A1 Find length AB



$$\cos 63 \times 7.1 = 3.2 \text{ cm}$$

A2 Find length AB

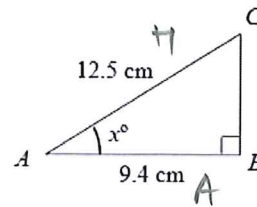


$$\tan 35 = \frac{4.3}{A}$$

$$A = \frac{4.3}{\tan 35}$$

$$A = 6.1$$

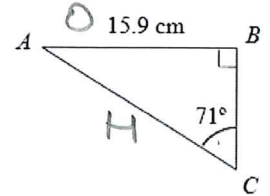
A3 Find angle BAC



$$\cos^{-1}\left(\frac{9.4}{12.5}\right)$$

$$x = 41.2^\circ$$

A4 Find length AC

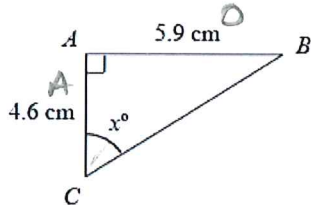


$$\sin 71 = \frac{15.9}{H}$$

$$H = \frac{15.9}{\sin 71}$$

$$H = 16.8$$

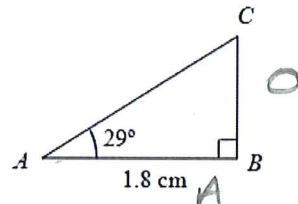
B1 Find angle ACB



$$\tan^{-1}\left(\frac{5.9}{4.6}\right)$$

$$x = 52.1^\circ$$

B2 Find length BC

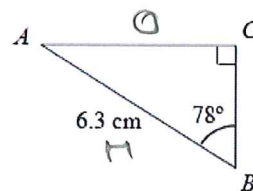


$$\tan 29 = \frac{0}{1.8}$$

$$1.8 \times \tan 29 = 0$$

$$0 = 1 \text{ cm}$$

B3 Find length AC

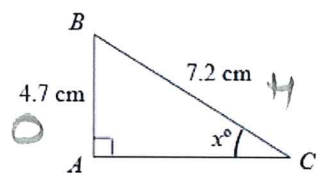


$$\sin 78 = \frac{0}{6.3}$$

$$6.3 \times \sin 78 = 0$$

$$0 = 6.2 \text{ cm}$$

B4 Find angle ACB



$$\sin^{-1}\left(\frac{4.7}{7.2}\right)$$

$$x = 40.8^\circ$$

Rounding and Estimation

Round to 1 sig fig when estimating

1) Round each of the following numbers to 1 significant figure:

a. 46,313 50 000

b. 57,123 60 000

c. 30,569 30 000

d. 94,558 90 000

e. 85,299 90 000

f. 0.5388 0.5

g. 0.2823 0.3

h.

i. 0.00584 0.006

i. 0.04785 0.05

j. 0.000876 0.0009

k. 9.9 10

l. 89.5 90

m. 90.78 90

n. 199 200

o. 999.99 1000

2) Round each of the following numbers to 2 significant figures:

a. 56,147 56 000

b. 26,813 27 000

c. 79,611 80 000

d. 30,578 31 000

i. 8.0089 8.0

j. 41.564 42

k. 0.8006 0.8

l. 0.458 0.46

e. 14,009 14000

m. 0.0658 0.066

f. 1.689 1.7

n. 0.9996 1.0

g. 4.0854 4.1

o. 0.00982 0.01

h. 2.658 2.7

3) Round each of the following to the certain number of significant figures

a. 57,402 (1sf) 60000

g. 0.261 (1sf) 0.3

b. 5288 (1sf) 5000

h. 0.732 (1sf) 0.7

c. 89.67 (3sf) 89.7

i. 0.42 (1sf) 0.4

d. 105.6 (2sf) 110

j. 0.758 (1sf) 0.8

e. 8.69 (1sf) 9.0

k. 0.185 (1sf) 0.2

f. 1.087 (2sf) 1.1

l. 0.682 (1sf) 0.7

4) Find approximate answers to the following:

a. $5,435 \times 7.31$ 35000
 5000×7

d. $354 \div 79.8$ $400 \div 80 = 5$

b. $5,280 \times 3.211$ 15000
 5000×3

e. $5,974 \div 5.29$ $6000 \div 5 = 1200$

c. $63.24 \times 3.514 \times 4.2$ 960
 $60 \times 4 \times 4$

f. $208 \div 0.378$ 500
 $200 \div 0.4$

Ratio and proportion

A1 Share £60 in the ratio 1:4 15 : 45	A2 Share \$350 in the ratio 4:3 200 : 150	A3 Share £200 in the ratio 3:1:4 75 : 25 : 100	A4 Chris and Maddie share \$120 in the ratio 3:5 How much do they each receive? 45 : 75
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B1 Red and yellow paint are mixed to make orange. Sam mixes 600 ml of red with 400 ml of yellow. Write the ratio of red to yellow. Give the ratio in its simplest form.	B2 A school has a total of 900 pupils. 400 pupils are boys and the rest are girls. Find the ratio of boys to girls. Give the ratio in its simplest form.	B3 Nial and Alex have played table tennis against each other 30 times. The ratio of the number of times Nial has won to the number of times Alex has won is 3:7. How many times has Alex won?	B4 1360 people watch a hockey match. The ratio male to female is 3:1. How many more males than females watch the match?
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$$\begin{array}{l}
 R : Y \\
 600 : 400 \\
 6 : 4 \\
 3 : 2
 \end{array}$$

$$\begin{array}{l}
 B : G \\
 400 : 500 : 900 \\
 4 : 5
 \end{array}$$

$$\begin{array}{l}
 N : A \\
 3 : 7 \quad 30 \\
 9 : (21)
 \end{array}$$

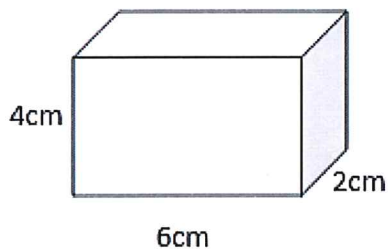
$$\begin{array}{l}
 M : F \\
 3 : 1 \\
 1020 : 340 : 1360 \\
 1020 - 340 \\
 680 \\
 \text{more}
 \end{array}$$

C1 In a school, there are 75 boys in the tennis squad. The ratio of the number of girls to the number of boys is 4:3. How many girls in the tennis squad? $4:3$ $100 \rightarrow 75$ $4:3 \rightarrow 100:75$	C2 Flaky pastry can be made using flour and fat in the ratio 4:3. Jake makes some flaky pastry using 90 grams of fat. What weight of flour does he use? $4:3$ $120 \rightarrow 90$ $4:3 \rightarrow 120:90$	C3 To make grey paint, black paint and white paint are mixed in the ratio 4:7. Tom uses 300 ml of black paint. How much white paint does he use? $4:7$ $300 \rightarrow 525$ $4:7 \rightarrow 300:525$	C4 The sides of a triangle are in the ratio 2:4:5. The length of the longest side of the triangle is 15 cm. Work out the perimeter of the triangle. $2:4:5$ $6:12:15$ $6+12+15 = 33$ cm
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D1 Jack, Evan and Molly share some money in the ratio 5:9:6. In total, Jack and Molly receive \$77. Work out the amount of money that Evan receives. $5:9:6$ $11 \text{ parts} = \$77$ $1 \text{ part} = \$7$ $9 \times 7 = \$63$	D2 At a school the ratio of the number of boys to number of girls is 9:11. There are 96 more girls than boys. Work out the total number of students at the school. $9:11$ $2 \text{ parts} = 96$ $1 \text{ part} = 48$ $9 \times 48 = 432$ $11 \times 48 = 528$ 960 pupils	D3 Nathan, Ayesha and Jordan share some money in the ratio 3:6:4. Ayesha gets £18 more than Nathan. Work out the amount of money that Jordan gets. $3:6:4$ $3 \text{ parts} = £18$ $1 \text{ part} = £6$ $4 \times 6 = £24$	D4 Siyoni, Adam and Ben share some money in the ratio 5:3:4. In total, Adam and Ben receive \$84. Work out how much they each get. $5:3:4$ $7 \text{ parts} = \$84$ $1 \text{ part} = \$12$ $60:36:48$
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Volume

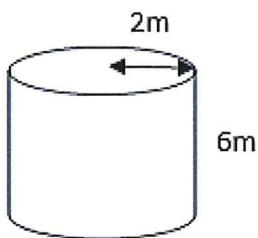
Cuboid A



Volume of cuboid = Length x Width x Height

$$4 \times 6 \times 2 = 48\text{cm}^3$$

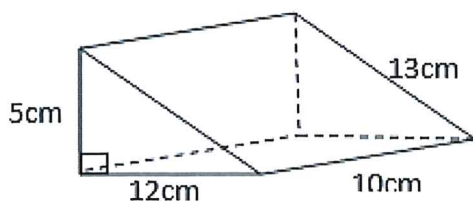
Cylinder A



Volume of cylinder = Area of Circle x Length

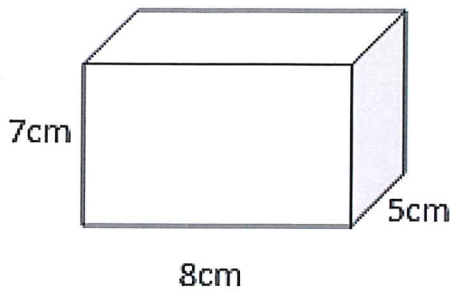
$$\pi \times 2^2 \times 6 = 75.4\text{cm}^3$$

Triangular Prism A



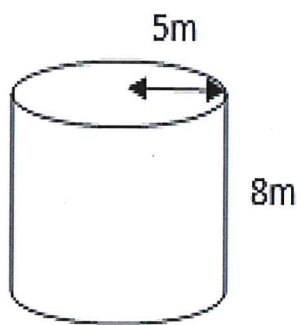
Volume of triangular prism = Area of triangle x length

$$\frac{5 \times 12}{2} \times 10 = 300$$

Cuboid B

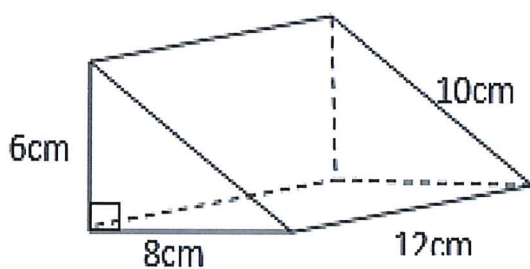
Volume of cuboid = Length x Width x Height

$$7 \times 8 \times 5 = 280 \text{ cm}^3$$

Cylinder B

Volume of cylinder = Area of Circle x Length

$$\pi \times 5^2 \times 8 = 628.3 \text{ cm}^3$$

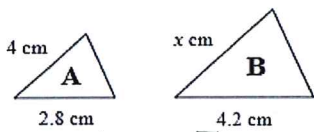
Triangular Prism B

Volume of triangular prism = Area of triangle x
length

$$\frac{6 \times 8}{2} \times 12 = 288 \text{ cm}^3$$

Similar Shapes including area

A1 Shape A is similar to shape B

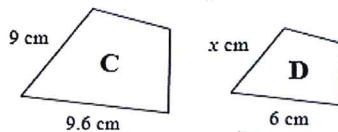


Work out the value of x .

$$\times 1.5$$

$$4 \times 1.5 = 6 \text{ cm}$$

A2 Shape C is similar to shape D



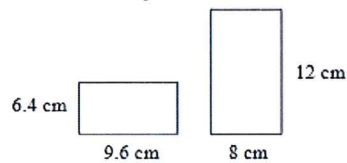
Work out the value of x .

$$\times 0.625$$

$$9 \times 0.625$$

$$x = 5.625 \text{ cm}$$

A3 Do some calculations to work out if the rectangles are mathematically similar.

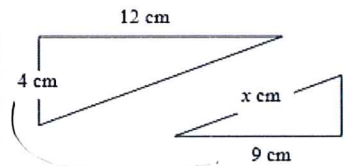


$$\times \frac{5}{6}$$

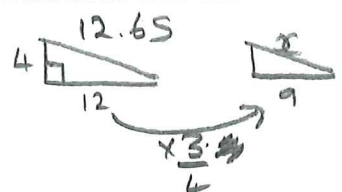
$$6.4 \times \frac{5}{6} \neq 12$$

No

A4 The two triangles are similar

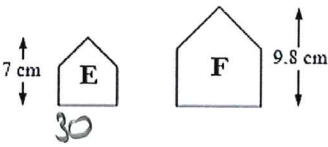
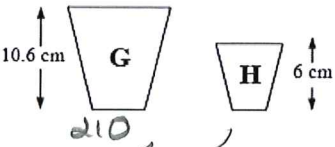
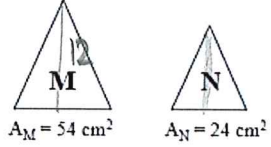
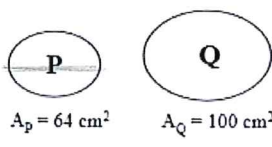


Work out the value of x .



$$\sqrt{12^2 + 4^2} = 12.65$$

$$x = 9.5 \text{ cm}$$

<p>B1 Shape E is similar to shape F The area of E is 30 cm^2</p>  <p>Calculate the area of F.</p>	<p>B2 Shape G is similar to shape H The area of G is 210 cm^2</p>  <p>Calculate the area of H.</p>	<p>B3 Shape M is similar to shape N The height of M is 12 cm.</p>  <p>Calculate the height of N.</p>	<p>B4 Shape P is similar to shape Q The width of Q is 14 cm.</p>  <p>Find the width of P.</p>
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$$\frac{S_f}{S_e} = \left(\frac{7}{9.8}\right)^2$$

$$S_f = \frac{30 \times 49}{25}$$

$$30 \times \frac{49}{25} = 58.8 \text{ cm}^2$$

$$\frac{S_f}{S_g} = \left(\frac{10.6}{6}\right)^2$$

$$\text{area } S_f = \frac{210 \times 36}{100}$$

$$\times 210$$

$$\text{Area} = 655.43 \text{ cm}^2$$

$$\frac{B \times 12}{2} = 54$$

$$\frac{B \times 12}{2} = 54$$

$$B \times 12 = 108$$

$$B = 9$$

$$12 : N = 9 : 4$$

$$54 : 24$$

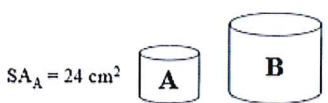
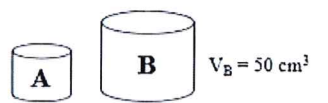
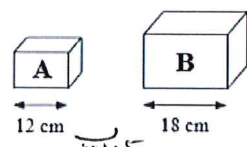
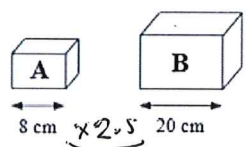
$$9 : 4$$

$$\text{height } N = 8 \text{ cm}$$

$$\frac{64}{100} = \left(\frac{14}{\text{width of P}}\right)^2$$

$$\text{width of P} = \frac{14 \times 5}{4}$$

$$\text{width of P} = 17.5 \text{ cm}$$

<p>C1 Cylinders A and B are similar Cylinder B is 1.6 times as high as cylinder A.</p>  <p>Calculate the surface area of B.</p>	<p>C2 Cylinders A and B are similar Cylinder B is 1.4 times as high as cylinder A.</p>  <p>Calculate the volume of A.</p>	<p>C3 Cuboids A and B are similar The volume of A is 250 cm^3.</p>  <p>Calculate the volume of B.</p>	<p>C4 Cuboids A and B are similar The surface area of B is 1000 cm^2.</p>  <p>Calculate the surface area of A.</p>
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$$SA_A = 24 \text{ cm}^2$$

$$24 \times 1.6^2 = 61.44 \text{ cm}^2$$

$$A \times 1.4 = B$$

$$50 \div 1.4^3$$

$$= 18.22 \text{ cm}^3$$

$$250 \times 1.5^3$$

$$= 843.75 \text{ cm}^3$$

$$1000 \div 2.5^2$$

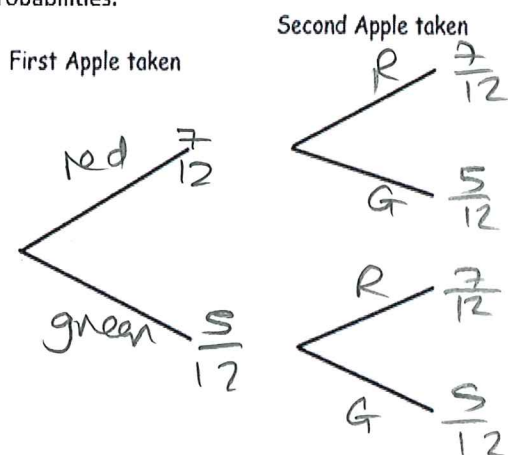
$$= 160 \text{ cm}^2$$

Probability

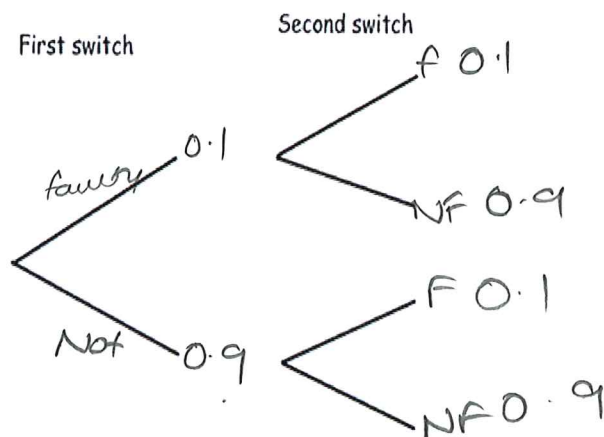
<p>A1 An ordinary coin is tossed. What is the probability that the coin lands on heads?</p> $\frac{1}{2}$	<p>A2 An ordinary dice is thrown. What is the probability that the dice lands on a prime number?</p> $\frac{3}{6}$	<p>A4 Amita picks a card from an ordinary pack of 52 playing cards. What is the probability that she picks a King?</p> $\frac{4}{52} \quad \frac{1}{13}$
<p>B1 A class consists of 18 girls and 15 boys. One of the students is selected at random. Calculate the probability that the student selected is a boy.</p> $\frac{15}{33}$	<p>B2 A fish tank contains 8 guppies, 5 platies and 7 mollies. 20 One of the fish is selected at random. Calculate the probability that the fish selected is a guppy.</p> $\frac{8}{20}$	<p>B4 Jack has cans of soup which don't have labels. He knows that <u>3 cans are tomato</u>, 4 cans are mushroom and 7 cans are chicken flavour. If he picks a can at random, what is the probability that the can chosen is not tomato? $\frac{11}{14}$</p>
<p>C1 A bag contains 3 red counters and 2 blue counters. One of the counters is selected at random. Find the probability that the counter selected is blue.</p> $\frac{2}{5}$	<p>C2 A bag contains 2 red counters, 5 green counters and 4 blue counters. One of the counters is selected at random. Find the probability that the counter selected is either red or blue.</p> $\frac{6}{11}$	<p>C4 A bag contains 4 red counters, 7 blue counters and 5 green counters. One of the counters is selected at random. Find the probability that the counter selected is not blue.</p> $\frac{9}{16}$
<p>D1 A letter is selected at random from the set {M, A, T, H, E, M, A, T, I, C, S} Find the probability that the letter 'M' is selected.</p> $\frac{2}{11}$	<p>D2 A letter is selected at random from the set {P, R, O, B, A, B, I, L, I, T, Y} Find the probability that a vowel is selected.</p> $\frac{4}{11}$	<p>D4 Each month of the year is written on a card and placed in a bag. One of the cards is selected at random. Calculate the probability that the month written on the card has 30 days.</p> $\frac{4}{12}$

Independent Events - Probability trees

1) A basket contains 7 red apples and 5 green apples. An apple is taken at random from the basket and then replaced. Another apple is taken from the basket. Complete the tree diagram to show all possible outcomes and their probabilities.



2) A manufacturer fits 2 switches to a circuit board. The probability that a switch is faulty is 0.1. Complete the tree diagram to show all possible outcomes and their probabilities.



1)a) Find the probability that at least one green apple is picked.

P(at least one green) =

$$\frac{7}{12} \times \frac{5}{12} + \frac{5}{12} \times \frac{7}{12} + \frac{5}{12} \times \frac{5}{12} = \frac{95}{144}$$

1)b) Find the probability that exactly one green apple is picked.

P(exactly one green)

$$\frac{7}{12} \times \frac{5}{12} + \frac{5}{12} \times \frac{7}{12}$$

$$\frac{70}{144}$$

2)a) What is the probability that circuit board works?

$$0.1 \times 0.9 + 0.9 \times 0.1 = 0.09 + 0.09 = 0.18$$

2)b) Calculate the probability that the circuit board does not work.

$$0.1 \times 0.1 + 0.9 \times 0.1 = 0.1$$

Averages from grouped data

1. The lifetime of 100 batteries are shown in the table below. Calculate an estimate of the mean, the class in which the median lies and state the modal class.

Time (hours)	$0 < x \leq 3$	$3 < x \leq 6$	$6 < x \leq 9$	$9 < x \leq 12$	$12 < x \leq 15$	$15 < x \leq 18$	$18 < x \leq 21$
Frequency	2	3	16	34	27	13	5
	1.5	4.5	7.5	10.5	13.5	16.5	19.5
	3	13.5	120	357	364.5	214.5	97.5

$$\text{mean} = \frac{1170}{100} = 11.7$$

modal = $9 < x \leq 12$

median $9 < x \leq 12$

2. The grouped frequency table shows information about the number of hours worked by each of 200 head teachers in one week. Calculate an estimate of the mean, the class in which the median lies and state the modal class.

Number of hours worked (t)	Frequency
$0 < t \leq 30$	0
$30 < t \leq 40$	4
$40 < t \leq 50$	18
$50 < t \leq 60$	68
$60 < t \leq 70$	79
$70 < t \leq 80$	31

mpt

15

35

45

55

65

75

mpt x f

0

140

810

3740

5135

2325

12150

$$12150 \div 200 = 60.75$$

modal = $60 < t \leq 70$
median $60 < t \leq 70$

200

Simultaneous equations

Elimination

A1 Solve

$$x + y = 1$$

$$x - y = 5$$

$$\underline{2x = 6}$$

$$x = 3$$

$$y = -2$$

A2 Solve

$$5x + y = 17$$

$$x + y = 3$$

$$4x = 14$$

$$x = 3.5$$

$$y = 0.5$$

A3 Solve

$$6x - 5y = 9$$

$$6x + 3y = 33$$

$$-8y = -24$$

$$y = 3$$

$$6x - 15 = 9$$

$$6x = 24$$

$$x = 4$$

A4 Solve

$$x + 5y = -13$$

$$4x - 5y = 48$$

$$5x = 35$$

$$x = 7$$

$$7 + 5y = -13$$

$$5y = -20$$

$$y = -4$$

B1 Solve

$$8x - y = 7$$

$$12x - 8y = 6$$

$$64x - 8y = 56$$

$$12x - 8y = 6$$

$$52x = 50$$

$$x = \frac{25}{26}$$

$$y = \frac{191}{13}$$

B2 Solve

$$3x - 2y = 13$$

$$x - y = 5$$

$$3x - 2y = 13$$

$$2x - 2y = 10$$

$$x = 3$$

$$y = -2$$

B3 Solve

$$2x - 3y = 3$$

$$3x + 6y = 1$$

$$4x - 6y = 6$$

$$3x + 6y = 1$$

$$7x = 7$$

$$x = 1$$

$$y = -1$$

B4 Solve

$$3x + 5y = 7$$

$$9x + 11y = 13$$

$$9x + 15y = 21$$

$$9x + 11y = 13$$

$$4y = 8$$

$$y = 2$$

$$3x + 10 = 7$$

$$x = -1$$

Upper and lower bounds

A1 Zoe weighs 62 kg, correct to the nearest kilogram. Write down the lower bound for Zoe's weight.	A2 The length of line $AB = 8.3$ cm, correct to 2 significant figures. Write down the upper bound for the length of AB .	A3 Anu weighs 83 kg, correct to the nearest <u>half</u> kilogram. Write down the upper bound for Anu's weight.	A4 The length of line $CD = 27$ cm, correct to the nearest 0.5 cm Write down the lower bound for the length of CD .
B1 Correct to the nearest millimetre, the length of a side of a regular hexagon is 3.6 cm Calculate the upper bound for the perimeter of the hexagon.	B2 The perimeter of a square is 24 cm, correct to the nearest half centimetre. Work out the lower bound for the length of a side.	B3 Correct to 1 significant figure, the area of a rectangle is 80 cm^2 . Correct to 2 significant figures, the length of the rectangle is 12 cm. Calculate the upper bound for the width.	B4 Correct to 2 significant figures the area of a square is 230 cm^2 . Calculate the lower bound for the perimeter of the square.
C1 $x = 1.8$ correct to 1 decimal place. Calculate the lower bound for the value of $4x + 1$	C2 Correct to 1 significant figure, $a = 20$ and $b = 5$ Work out the upper bound of $5(a - b)$	C3 $x = p(q - r)$ $p = 42$, $q = 24$ and $r = 14$ all correct to 2 significant figures. Work out the lower bound for the value of x .	C4 Correct to 2 significant figures, $w = 58$, $x = 28$ and $y = 18$ Calculate the upper bound for the value of $\frac{w}{x - y}$

Percentages

A1

A bank pays 2.5% interest on its current account.

Write 2.5% as a decimal.

$$\underline{\underline{0.025}}$$

B1

Ayesha plays hockey.

Last year Ayesha scored 8 goals.

This year Ayesha scored 13 goals.

Calculate the percentage increase in for the number of goals scored.

$$\frac{5}{8} \times 100 = \underline{\underline{62.5\%}}$$

C1

Rohan invested £3000 for 4 years in a savings account. He was paid 2.5% per annum compound interest.

How much did Rohan have in his savings account after 4 years?

$$3000 \times 1.025^4 = \underline{\underline{£3311.44}}$$

D1

In a sale, normal prices were reduced by 25%. The sale price of a computer was £442.

Work out the normal price of the computer.

$$\begin{aligned} x \times 0.75 &= 442 \\ x &= 442 \div 0.75 \\ x &= \underline{\underline{£589.33}} \end{aligned}$$

In January 2007 the population of Canada was 32 million.
7 million of these Canadian people spoke French as their first language.

- (a) Express 7 million as a percentage of 32 million.
Give your answer correct to 1 decimal place.

$$\begin{aligned} \frac{7}{32} \times 100 &= 21.875 \\ &= \underline{\underline{21.9\%}} \end{aligned}$$

Between January 2007 and January 2009 the population of Canada increased by 4%.

(b) Increase 32 million by 4%.

Give your answer correct to the nearest million.

$$32 \times 1.04 = 33.28 \text{ million} \\ = \underline{\underline{33 \text{ million}}}$$

A2

Rosie took a science test and scored 41 marks out of 45.

Express 41 out of 45 as a percentage.

$$\frac{41}{45} \times 100 = \underline{\underline{91.1\%}}$$

B2

Between 2001 and 2011, the population of a town increased by 8%

In 2001 the population was 34 342. Calculate the population in 2011.

$$34342 \times 1.08 = \underline{\underline{37089}}$$

C2

Susanna invested £2000 for 3 years at 4% interest per annum compound interest.

Work out the amount of interest Susanna had earned after 3 years.

$$2000 \times 1.04^3 = \underline{\underline{£2249.73}}$$

D2

In a sale, all prices are reduced by 15%.

The sale price of a shirt is £22.40. Work out the original price of the shirt.

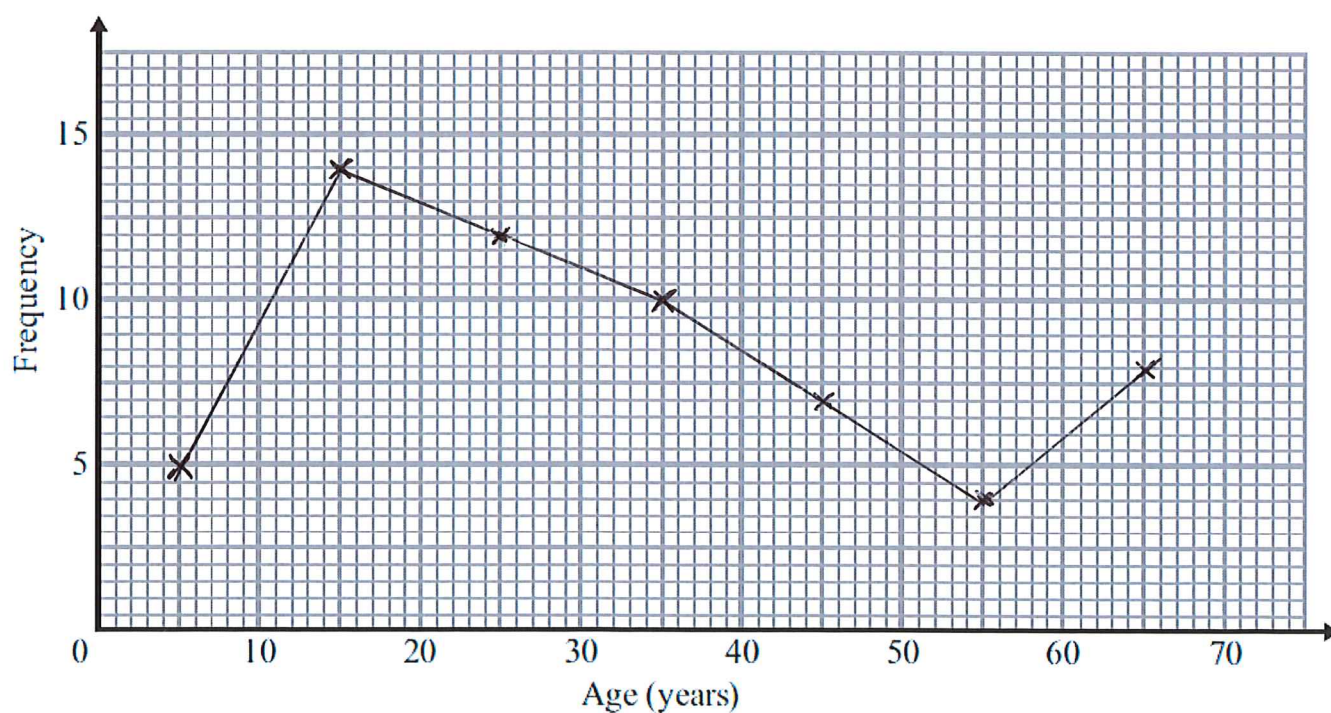
$$x \times 0.85 = 22.40 \\ x = 22.40 \div 0.85 \\ = \underline{\underline{£26.35}}$$

Frequency polygons

1. The table shows the age in years of 60 people.

a) On the grid, draw a frequency polygon for the information in the table.

Age (in years)	Frequency
$0 < a \leq 10$	5
$10 < a \leq 20$	14
$20 < a \leq 30$	12
$30 < a \leq 40$	10
$40 < a \leq 50$	7
$50 < a \leq 60$	4
$60 < a \leq 70$	8

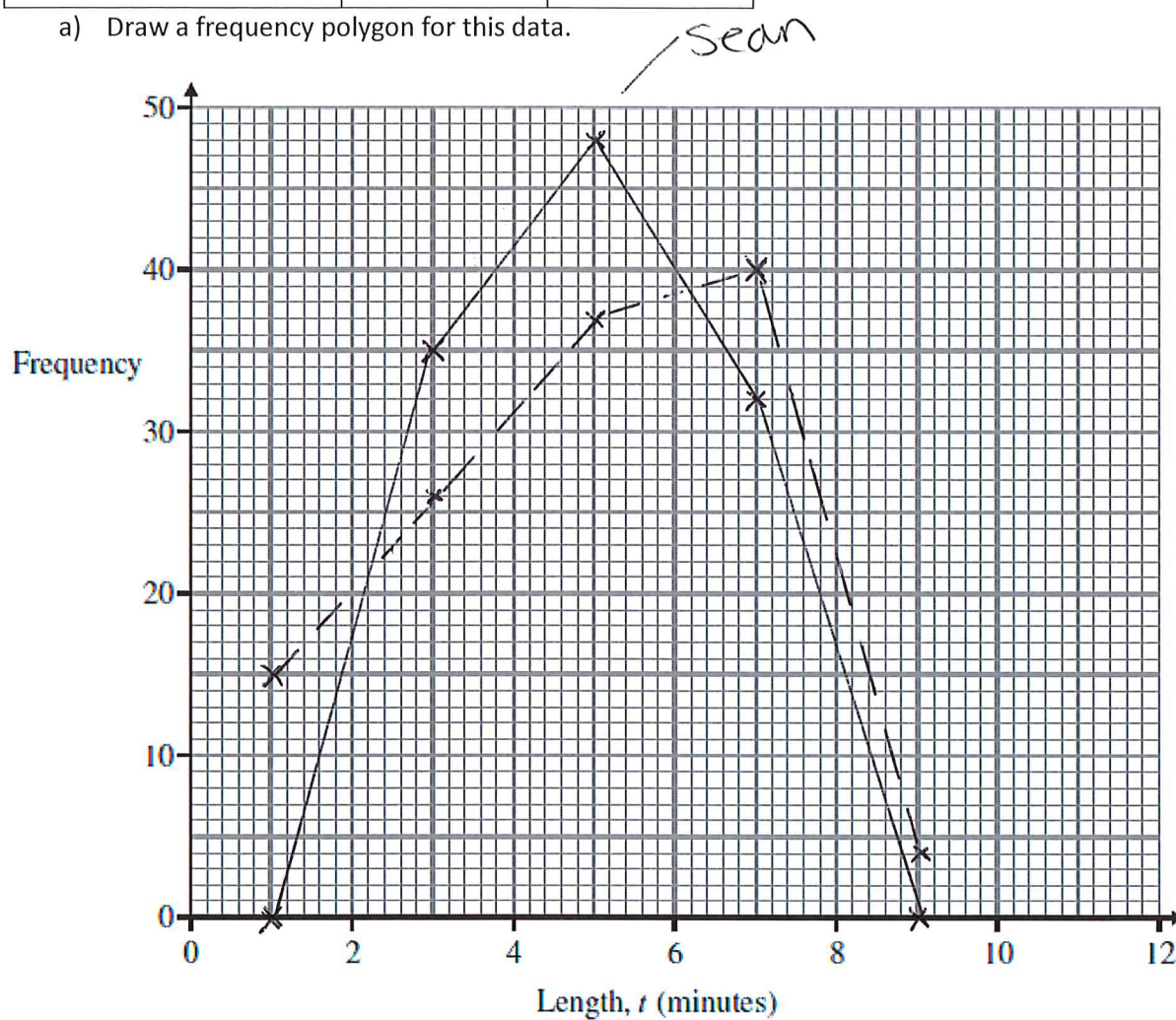


2. Sean and Sarah are telephone sales assistants.

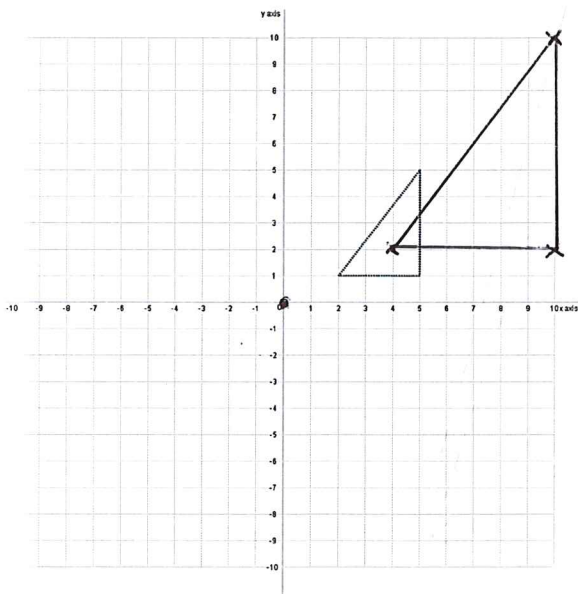
The length and frequency of the telephone calls made by them during one day are shown in the table.

Length, t (minutes)	Sean Frequency	Sarah Frequency
$0 < a \leq 2$	0	15
$2 < a \leq 4$	35	26
$4 < a \leq 6$	48	37
$6 < a \leq 8$	32	40
$8 < a \leq 10$	0	4

- a) Draw a frequency polygon for this data.



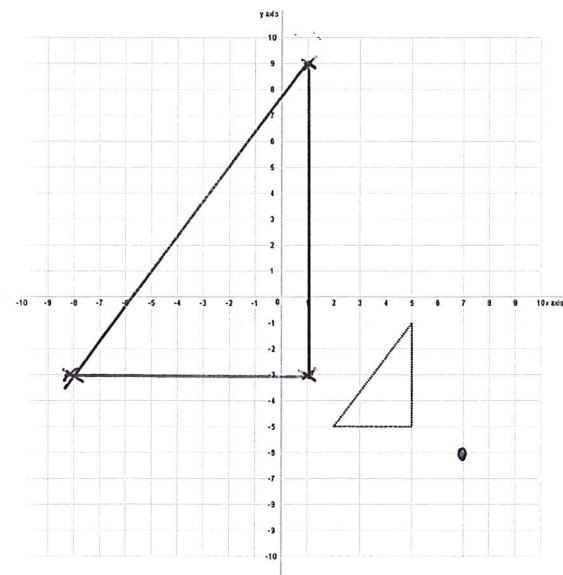
Enlargement



Enlarge by scale factor

2

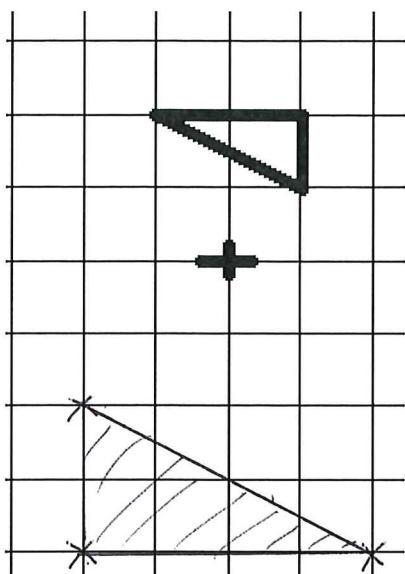
Centre of enlargement (0,0)



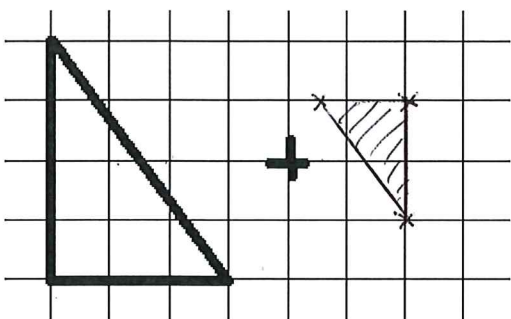
Enlarge by scale factor

3

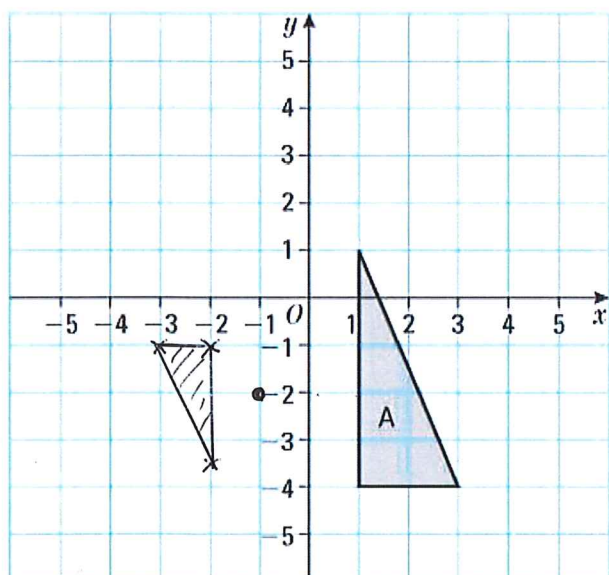
Centre of enlargement (7,-6)



Enlarge by Scale factor -2 from the centre marked



Enlarge by Scale factor $-\frac{1}{2}$ from the centre marked



Scale factor -1/2,
centre (-1,-2)

