

## BODMAS

- |   |                             |    |                                |
|---|-----------------------------|----|--------------------------------|
| 1 | $6 \times (-2 + -4) \div 2$ | 2  | $9 \times 2 - (-4)^2$          |
| 3 | $6 - [24 \div (-6 + 10)]$   | 4  | $5 + (1 - 3)^2$                |
| 5 | $4 \times -4 \div (-4)^2$   | 6  | $7 \times [-2 - (3 + -2)]$     |
| 7 | $9 \div [-7 + (-2)]$        | 8  | $[2 \times (-3)^2 - 8] \div 2$ |
| 9 | $5 - 3 \times 6 + 4 \div 3$ | 10 | $4 \div [(4 + -2) \times 2]$   |

## SIGNIFICANT FIGURES

**Round these to 2 significant figures**

- |    |          |    |        |    |         |
|----|----------|----|--------|----|---------|
| 1  | 56.57    | 2  | 56.057 | 3  | 0.5679  |
| 4  | 0.005643 | 5  | 89.76  | 6  | 0.777   |
| 7  | 3.045    | 8  | 1111   | 9  | 0.0847  |
| 10 | 35548    | 11 | 980765 | 12 | 0.00645 |

**Round these to 3 significant figures**

- |    |          |    |        |    |         |
|----|----------|----|--------|----|---------|
| 1  | 56.57    | 2  | 56.057 | 3  | 0.5679  |
| 4  | 0.005643 | 5  | 89.76  | 6  | 0.777   |
| 7  | 3.045    | 8  | 1111   | 9  | 0.0847  |
| 10 | 35548    | 11 | 980765 | 12 | 0.00645 |

## SCIENTIFIC NOTATION

- 1 A hydrogen atom weighs 0.000 000 000 000 000 000 000 001 67 grams.  
Write this in standard form.
- 2 The area of the surface of the Earth is about 510 000 000 km<sup>2</sup>.  
Express this in Standard Form.
- 3  $E = mc^2$  is the formula for Einstein's theory of relativity.  
Find E if  $m = (8 \times 10^{-3})$  kg and  $c = (3 \times 10^8)$  m/s.
- 4 The total number of visitors to an exhibition was  $3.9 \times 10^5$ .  
The exhibition was open each day from 18<sup>th</sup> June to 18<sup>th</sup> September inclusive. Calculate the average number of visitors per day to the exhibition.  
Answer in scientific notation to 2 significant figures.
- 5 Neptune is at an average distance of  $4.5 \times 10^9$  kilometres from the sun, and the speed of light is  $3.12 \times 10^5$  kilometers per second. Calculate to the nearest half hour, the time taken for the light from the sun to reach the planet.
- 5 A very rich oil sheikh leaves his fortune of  $\pounds 3.6 \times 10^8$  to be divided between his 48 children. How much does each child receive? Give the answer in standard form.

# EXPANDING BRACKETS

1 Remove the brackets: Single bracket

a)  $3(a-4)$

b)  $7(5-2b) + 15$

c)  $3(2w-3) - 2w$

d)  $2x(x-3) + 3(4-x^2)$

e)  $5x^2 + 3x - 2(6x-5)$

f)  $3y(4y-3) - 2y(3y-4)$

2 Remove the brackets: Double brackets

a)  $(a+5)(a-4)$

b)  $(6-a)(5-a)$

c)  $(w+3)^2$

d)  $(2x-3)^2$

e)  $(x-2)(6x-5) + (x-3)^2$

f)  $(3y+4)(3y-4)$

3 Remove the brackets: Harder type

a)  $(3x+2)^3$

b)  $(2x-1)(2x+3) - (x-5)^2$

c)  $\left(p + \frac{2}{p}\right)^2$

d)  $(x-2)(6x^2+3x-5)$

4 The square and the rectangle shown below have the same PERIMETER.



Show that the length of the rectangle =  $(3x + 1)$  cms.

# FACTORISATION

1 Factorise:

a)  $4x+6$

b)  $x^2 - 3x$

2 Factorise:

a)  $5x^2 - 15x$

b)  $a^2b + ab^2$

3 Factorise:

a)  $a^2 - 25$

b)  $4a^2 - 81$

4 Factorise:

a)  $x^2 + 5x + 6$

b)  $x^2 - 10x + 16$

c)  $x^2 + 4x - 21$

d)  $x^2 - 2x - 35$

5 Factorise:

a)  $3x^2 - 7x - 6$

b)  $8m^2 - 18m + 9$

c)  $15p^2 + 14p - 8$

d)  $42x^2 + 29x - 5$

# FRACTIONS

1 Evaluate :

(a)  $\frac{7}{9} - \frac{2}{3}$

(b)  $\frac{7}{9} + \frac{2}{3}$

(c)  $3\frac{3}{5} + 1\frac{3}{10}$

(d)  $4\frac{3}{8} - 2\frac{3}{4}$

2 Work out these fraction problems :

(a)  $\frac{7}{9} \times \frac{3}{14}$

(b)  $3\frac{1}{3} \times 1\frac{4}{5}$

3 Work out these fraction problems :

(a)  $\frac{2}{7} \div \frac{3}{14}$

(b)  $3\frac{1}{3} \div 1\frac{2}{3}$

4 Andrew can cover the roof of a house in 3 days.

Bill can make this job in 6 days.

How long will it take to Andrew and Bill to complete the job working together?

(Hint: Andrew covers  $\frac{1}{3}$  of the roof in a day and Bill covers..... )

5 One tube can fill the reservoir with the water in 12 hours.

The second tube can fill the reservoir with the water in 36 hours, when it works separately.

How long will it take to fill the reservoir, if two tubes work simultaneously?

(Hint: The first tube fills  $\frac{1}{12}$  of the reservoir in an hour and the second tube..)

6 The tube can fill a reservoir with the water in 3 days.

An elephant can drink all the water from the reservoir in 4 days.

How long will it take to fill the reservoir, if the tube fills it and the elephant drinks the water at the same rates?

# PERCENTAGES

- 1 Erica deposits £850 with the Handshake Building Society, which pays 4% compound interest Half Yearly.
- a) How much will she have altogether at the end of one year?  
b) Compare this with an *annual* 8% simple interest rate.



2. David Barr deposited £250 in a bank for three years, leaving the interest to be added to his account each year. The annual rate of interest dropped from 10% in the first year to 8% in the second and 6% in the third year. How much money was in his account after three years?

3. A local council takes out a loan of £1 400 000 to pay for a new swimming pool. The annual rate of compound interest is 13%. How much, to the nearest £, does the council owe at the end of four years if none of the loan has been repaid?



4. Alison invests £400 in an account paying compound interest at 4% per annum. Find the interest earned over three years. Answer to the nearest £0.01.



5. A vintage car bought for £52 000 appreciates in value by 15% in the first year after purchase.

The rate of appreciation then falls to 12 % in subsequent years.

- a) What is the car worth five years after purchase? Answer to 3 s.f.  
b) What is the percentage gain in value over the five-year period? Answer to 2 s.f.



6.



The population of Dunfermline is increasing at a rate of 2% per annum. The population of Dunfermline is 55 400 currently.

What will be the population in three years time?

Answer to the nearest 10 people.

7. A dress costs £125.60  
In a sale the price is reduced by 35%.  
Calculate the sale price of the dress.

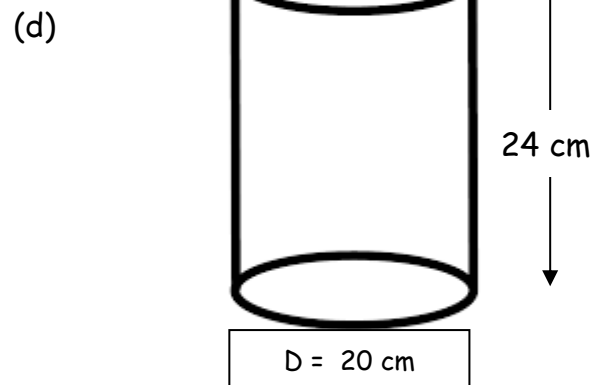
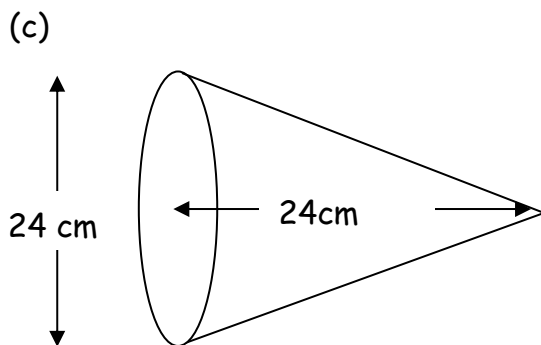
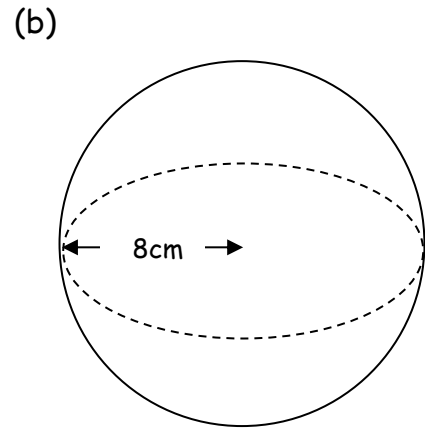
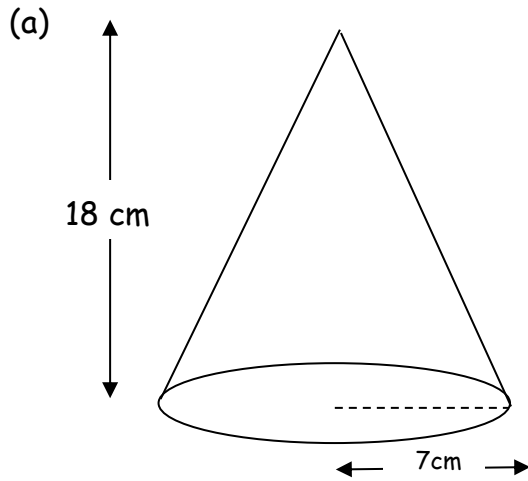


8. Mary's house is worth £285 000 after an appreciation of 16% over the last year.  
How much was the house worth originally

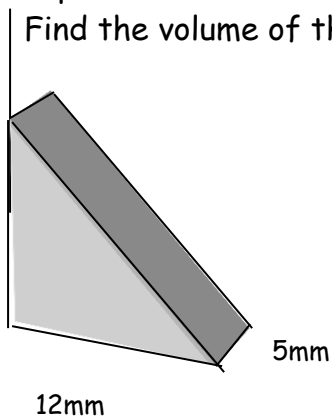


# VOLUMES

1 For each of the solid shapes below, calculate the volume, correct to 1 dec. place.

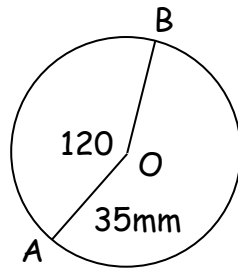


2 A prism has a cross-section consisting of a right angled isosceles triangle. Find the volume of the prism. ( $V = Ah$ )

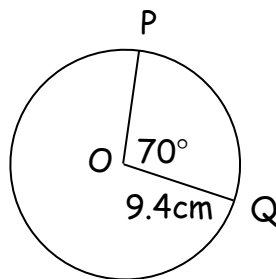


# CIRCLES 1

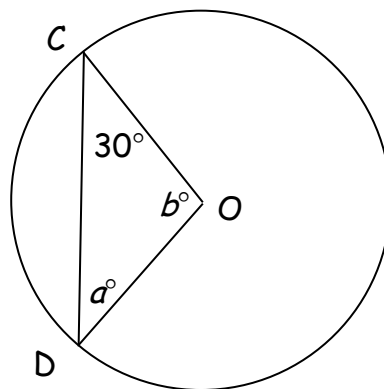
- 1 Calculate the length of the minor arc  $AB$  in the circle with radius 35 millimetres.



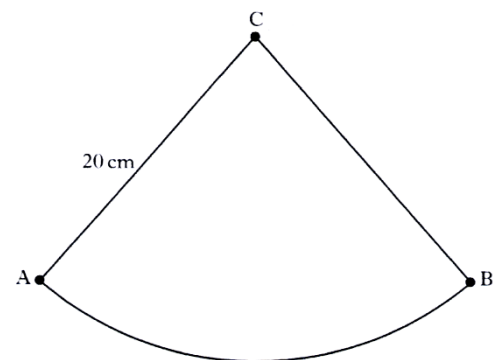
- 2 Calculate the area of the sector  $OPQ$  in the circle with radius 9.4 centimetres.



- 3 Copy the circle and calculate the size of  $a$  and  $b$



- 4 A pendulum travels along an arc of a circle, centre  $C$ .  
The length of the pendulum is 20 cms.  
The pendulum swings from  $A$  to  $B$ .  
The length of the arc  $AB$  is 28.6 cms.  
Find the angle through which the pendulum swings from  $A$  to  $B$ .





## COMPLETING THE SQUARE

1)  $y = x^2 + 4x - 9$

2)  $y = x^2 - 6x - 22$

3)  $y = x^2 + 2x - 3$

4)  $y = x^2 - 6x + 2$

5)  $y = x^2 + 2x + 13$

6)  $y = x^2 - 4x + 15$

7)  $y = x^2 + 8x - 5$

8)  $y = x^2 + 6x - 12$

9)  $y = 17 + 8x - x^2$

10)  $y = 29 + 20x - x^2$

11)  $y = -11 - 6x - x^2$

12)  $y = 5.25 - 3x - x^2$

13)  $y = 121 + 12x - x^2$

14)  $y = 7 - x - x^2$

# SURDS

1. Simplify the following.....

(a)  $\sqrt{40}$

(b)  $\sqrt{24}$

(c)  $\sqrt{28} + \sqrt{7}$

(d)  $\sqrt{3} + \sqrt{300}$

(e)  $\sqrt{125} - \sqrt{80}$

(f)  $\frac{\sqrt{120}}{\sqrt{6}}$

(g)  $\sqrt{\frac{25}{12}}$

(h)  $\sqrt{2} \times \sqrt{50}$

(i)  $\sqrt{8} \times \sqrt{5} \times \sqrt{10}$

(j)  $\frac{\sqrt{3}}{\sqrt{6} \times \sqrt{24}}$

2. Rationalise the denominator of each of the following...

(a)  $\frac{4}{\sqrt{6}}$

(b)  $\frac{8}{5\sqrt{2}}$

(c)  $\frac{7x}{4 - \sqrt{8}}$

3. Simplify the following....

(a)  $\sqrt{40}$

(b)  $\sqrt{\frac{50}{100}}$

(c)  $\sqrt{45} - \sqrt{20}$

(d)  $\sqrt{50} - \sqrt{8}$

4. Simplify the following...

(a)  $\frac{\sqrt{120}}{\sqrt{6}}$

(b)  $\sqrt{2} \times \sqrt{50}$

(c)  $\sqrt{8} \times \sqrt{5} \times \sqrt{10}$

# INDICES

1. Simplify the following, leaving your answer in index form...

(a)  $a^{-2} \times a^4$       (b)  $k^{-2} \times k^0$       (c)  $m^2 \div m^{-2}$       (d)  $t^{-4} \div t^{-3}$

2. Simplify the following...

(a)  $\frac{2x^2 \times x^4}{x^3}$       (b)  $\frac{\sqrt{x^2} \times x^7}{x^5}$       (c)  $c^{-2} \times 4c^{-3}$       (d)  $2w^2 \times 3w^4$

3. Write the following without brackets.

a.  $(2b)^2$       b.  $(7a)^3$       c.  $(3x)^4$       d.  $(2y)^5$   
e.  $(ab)^4$       f.  $(xy)^7$       g.  $(wz)^5$       h.  $(st)^3$   
i.  $(pq^2)^3$       j.  $(x^4y)^2$       k.  $(a^2b^3)^5$       l.  $(6a^5)^2$   
m.  $(10x^2)^3$       n.  $(2c^4)^5$       o.  $(3ab^2)^3$       p.  $(4m^2k)^2$

4. Simplify the following expressions.

a.  $m^3 \times m^{-5}$       b.  $x^7 \times x^{-2}$       c.  $p^{-8} \times p^5$       d.  $a^{-3} \times a^{-5}$   
e.  $(y^3)^{-4}$       f.  $(c^{-5})^3$       g.  $(q^3)^{-5}$       h.  $(w^{-2})^{-4}$   
i.  $4b^{-4} \times 5b^5$       j.  $3x^6 \times 9x^{-6}$       k.  $4k^3 \div 2k^{-2}$       l.  $18d \div 12d^4$   
m.  $x^2(x^3 + x^{-1})$       n.  $p^{-3}(p^4 - p^{-8})$       o.  $3a^5(2a + 3a^{-2})$       p.  $\frac{1}{2} m^{-2}(4m^{-3} - 10m^6)$   
q.  $\frac{v^3 \times v^5}{v^{-2}}$       r.  $\frac{4h^7 \times 3h^{-4}}{2h^4}$       s.  $\frac{4c^{-5} \times 9c^6}{6c^{-4}}$       t.  $\frac{5x^4 \times 6x^{-8}}{3x^{-4}}$

# SIMPLIFYING ALGEBRAIC EXPRESSIONS

1. Factorise these expressions and then simplify:-

(a)  $\frac{a+2}{5a+10}$

(b)  $\frac{2x+4}{5x^2+10x}$

(c)  $\frac{x^2-x-6}{2x^2+3x-2}$

2. Simplify :-

(a)  $\frac{3}{m^2} - \frac{2}{m}$

(b)  $\frac{x+2}{5} - \frac{x-3}{3}$

(c)  $\frac{6}{p+2} - \frac{5}{p-1}$

3. Simplify these multiplications and divisions:-

(a)  $\frac{4}{b^2} \times \frac{b}{2}$

(b)  $\frac{45}{d^2} \div \frac{5}{2d}$

(c)  $\frac{6q^3}{p} \times \frac{5p^2}{4q^4}$

## SUPER CHALLENGE FOR SUPERSTARS!

4.



$\frac{1}{3}x \text{ cm}$



4 cm

$\frac{4}{3}x \text{ cm}$

The square and the rectangle above have equal AREAS.

- Write down an expression for the area of the square.
- Write down an expression for the area of the rectangle.
- Make up an equation using your answer to (a) and (b).
- Multiply both sides by 9 to get rid of the denominators.
- You can't solve this type of equation yet by quadratics!  
Just by looking at it and thinking of the meaning of  $x^2$  you should be able to write down the value of  $x$ .
- Write down the area of the square.

# EQUATION OF A STRAIGHT LINE

1. For each line, write down the gradient and the coordinates of the point where it crosses the  $y$ -axis.

a  $y = 4x + 3$

b  $y = \frac{1}{2}x - 3$

c  $y = -3x + 3$

d  $y = -\frac{1}{4}x - 3$

e  $y = 2x - 5$

f  $y = -x + 4$

2. Match these equations with the graphs shown below.

a  $y = x + 1$

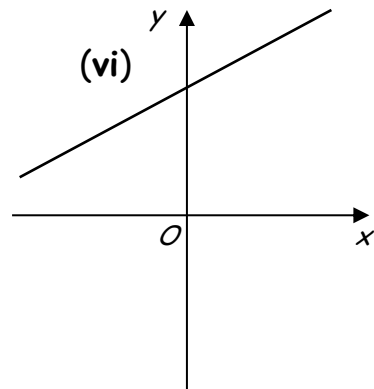
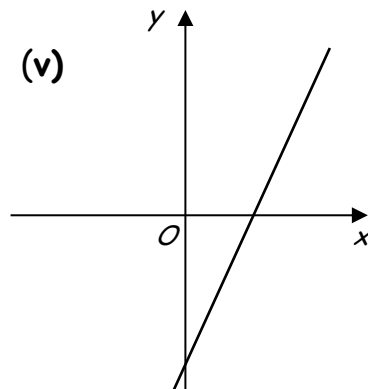
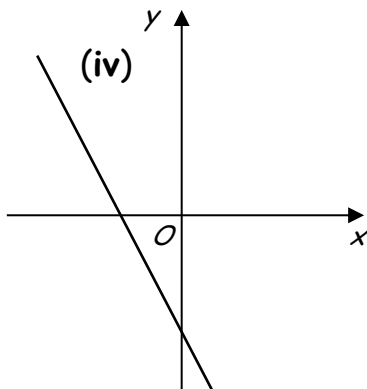
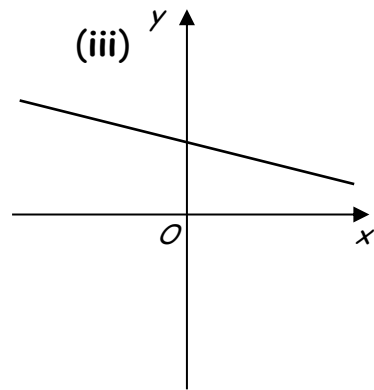
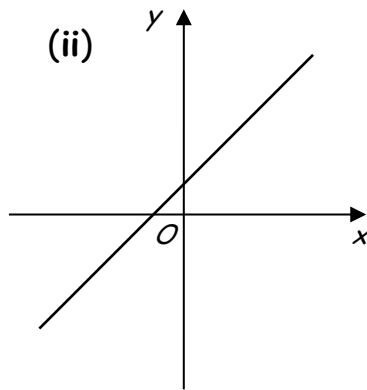
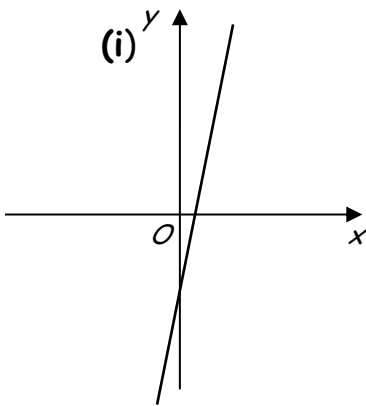
b  $y = -2x - 3$

c  $y = \frac{1}{2}x + 4$

d  $y = -\frac{1}{4}x + 2$

e  $y = 6x - 2$

f  $y = 3x - 5$



3. Sketch the graphs of lines with equations

a  $y = -x + 4$

b  $y = 3x + 3$

c  $y = 2x + 5$

d  $y = \frac{1}{2}x - 3$

e  $y = -3x - 2$

f  $y = -5x + 2$