

FIND 42% OF £300

$100\% = £300$
 $1\% = £3$
 $42\% = £126$

OR MULTIPLY BY DECIMAL
 $0.42 \times £300 = £126$

FIND % OF A QUANTITY

THE VALUE OF A £700 WATCH INCREASES BY 15% FIND THE NEW VALUE

$100\% = £700$
 $15\% = £105$
 $115\% = £805$

QUICKER TO USE MULTIPLIER
 $1.15 \times £700 = £805$

OLD VALUE: £700
 INCREASE BY 15%
 NEW VALUE: ?

MY WAGE INCREASES FROM £500 TO £615. FIND THE % CHANGE

$100\% = £500$
 $\text{CHANGE} = £615 - £500 = £115$
 $\% \text{ CHANGE} = \frac{\text{CHANGE}}{\text{OLD VALUE}} \times 100 = \frac{115}{500} \times 100 = 23\%$

OR USE THE MULTIPLIER
 $\frac{615}{500} = 1.23 = 123\% = 100\% + 23\%$

AFTER A 20% INCREASE THE COST OF AN AIR TICKET IS NOW £360. WHAT WAS THE ORIGINAL COST BEFORE THE INCREASE?

$100\% = ?$
 $20\% = ?$
 $120\% = £360$
 $1\% = £3$
 $100\% = £300$

OR USE THE MULTIPLIER
 $\frac{360}{1.20} = £300$

COMPARE QUANTITIES

$\frac{75}{60} = \frac{5}{4} = 1.25 = 125\%$
 $\frac{60}{75} = \frac{4}{5} = 0.8 = 80\%$

PERCENTAGES

THE PRICE OF A £400 PHONE DECREASES BY 7% FIND THE NEW PRICE

$100\% = £400$
 $7\% = £28$
 $93\% = £372$

QUICKER TO USE MULTIPLIER
 $0.93 \times £400 = £372$

OLD VALUE: £400
 DECREASE BY 7%
 NEW VALUE: ?

THE PRICE OF A BIKE DECREASES FROM £600 TO £516. FIND THE % CHANGE

$100\% = £600$
 $\text{CHANGE} = £600 - £516 = £84$
 $\% \text{ CHANGE} = \frac{\text{CHANGE}}{\text{OLD VALUE}} \times 100 = \frac{84}{600} \times 100 = 14\%$

OR USE THE MULTIPLIER
 $\frac{516}{600} = 0.86 = 86\% = 100\% - 14\%$

AFTER A 35% DECREASE THE PRICE OF A SOFA IS £455. WHAT WAS THE ORIGINAL PRICE OF THE SOFA?

$100\% = ?$
 $35\% = ?$
 $65\% = £455$
 $1\% = £7$
 $100\% = £700$

OR USE THE MULTIPLIER
 $\frac{455}{0.65} = £700$

INTEREST

SIMPLE INTEREST
 THE AMOUNT ADDED EACH YEAR IS THE SAME AS THE FIRST YEAR

COMPOUND INTEREST
 THE AMOUNT ADDED CHANGES EACH YEAR AS IT IS CALCULATED FROM THE MOST RECENT TOTAL

ASH INVESTS £5000 AT AN INTEREST RATE OF 2.9% PER ANNUM FOR 4 YEARS

YEAR 0: £5000
 YEAR 1: £5145
 YEAR 2: £5294.21
 YEAR 3: £5447.74
 YEAR 4: £5605.72

QUICKER TO USE MULTIPLIER

$100\% + 2.9\% = 102.9\% = \frac{1029}{100} = 1.029$

£5000 $\times 1.029$ = £5145
 £5145 $\times 1.029$ = £5294.21
 £5294.21 $\times 1.029$ = £5447.74
 £5447.74 $\times 1.029$ = £5605.72

£5000 $\times 1.029^4 = £5605.72$

GRADIENT OF THE LINE

$\frac{\text{PAY}}{\text{TIME}} = \frac{£12.50}{8 \text{ HOURS}} = £1.5625/\text{HOUR}$

COMPOUND UNITS

SMALL 300ml: £2.10
 MEDIUM 500ml: £3.25
 LARGE 1L: £6.30

BEST BUY

SMALL: £2.10 ÷ 3 = £0.70
 MEDIUM: £3.25 ÷ 5 = £0.65
 LARGE: £6.30 ÷ 10 = £0.63

LARGE IS THE BEST BUY

RATIO

SHOWS THE SIZE OF DIFFERENT GROUPS RELATIVE TO EACH OTHER

DOGS: CATS: RABBITS
 2: 3: 5

FINDING MISSING AMOUNTS

ASH: BOB: CAT
 3: 4: 2

IF ASH RECEIVES £36 HOW MUCH DO BOB AND CAT RECEIVE?

ASH = £36 ÷ 3 = £12
 BOB = 4 × £12 = £48
 CAT = 2 × £12 = £24

SCALE

SCALE 1:150

LENGTH OF BEDROOM ON THE PLAN IS 3.7cm
 ACTUAL LENGTH OF BEDROOM = 3.7cm × 150 = 555cm = 5.55m

RECIPES

MAKES 18 GINGERBREAD MEN
 FLOUR 250g
 BUTTER 120g
 GINGER 80g
 SUGAR 50g

MAKES 45 GINGERBREAD MEN
 FLOUR 625g
 BUTTER 300g
 GINGER 200g
 SUGAR 125g

PROPORTION

DIRECT PROPORTION
 AS x INCREASES, y INCREASES

INVERSE PROPORTION
 AS x INCREASES, y DECREASES

AS x INCREASES, y INCREASES

y is DIRECTLY PROPORTIONAL TO x³
 $y \propto x^3$
 IF x=2 THEN y=5×2³=40
 $y = 5x^3$
 IF y=320 THEN 320=5x³
 $x = \sqrt[3]{\frac{320}{5}} = 4$

IF x INCREASES BY A FACTOR OF a THEN y INCREASES BY A FACTOR OF a³

y is DIRECTLY PROPORTIONAL TO x²
 $y \propto x^2$
 IF x=4 THEN y=5×4²=80
 $y = 5x^2$
 IF y=245 THEN 245=5x²
 $x = \sqrt{\frac{245}{5}} = 7$

IF x INCREASES BY A FACTOR OF a THEN y INCREASES BY A FACTOR OF a²

y is DIRECTLY PROPORTIONAL TO x
 $y \propto x$
 IF x=7 THEN y=5×7=35
 $y = 5x$
 IF y=50 THEN x=50÷5=10

IF x INCREASES BY A FACTOR OF a THEN y INCREASES BY A FACTOR OF a

AS x INCREASES, y DECREASES

y is INVERSELY PROPORTIONAL TO x
 $y \propto \frac{1}{x}$
 IF x=2 THEN y=24÷2=12
 $y = \frac{24}{x}$
 IF y=8 THEN 8=24÷x
 $x = \frac{24}{8} = 3$

IF x INCREASES BY A FACTOR OF a THEN y DECREASES BY A FACTOR OF a

y is INVERSELY PROPORTIONAL TO x²
 $y \propto \frac{1}{x^2}$
 IF x=3 THEN y=72÷3²=8
 $y = \frac{72}{x^2}$
 IF y=18 THEN 18=72÷x²
 $x = \sqrt{\frac{72}{18}} = 2$

IF x INCREASES BY A FACTOR OF a THEN y DECREASES BY A FACTOR OF a²

MORE PROPORTION

DIRECT PROPORTION
 FINDING THE EQUATION

y is DIRECTLY PROPORTIONAL TO x²
 $y \propto x^2$
 $y = kx^2$
 WHEN x=5 y=100
 $100 = k \times 5^2$
 $100 = 25k$
 $k = 4$
 $y = 4x^2$

y is INVERSELY PROPORTIONAL TO x²
 $y \propto \frac{1}{x^2}$
 $y = \frac{k}{x^2}$
 WHEN x=3 y=10
 $10 = \frac{k}{3^2}$
 $10 = \frac{k}{9}$
 $k = 90$
 $y = \frac{90}{x^2}$

RATES OF CHANGE

AVERAGE RATE OF CHANGE OVER AN INTERVAL

THE AVERAGE RATE OF CHANGE OF TEMPERATURE FROM 0 mins TO 60 mins

$\frac{\text{TOTAL CHANGE IN TEMPERATURE}}{\text{TOTAL TIME TAKEN}} = \frac{-83^\circ\text{C}}{60 \text{ mins}} = -1.38^\circ\text{C/min}$

RATE OF CHANGE AT A POINT

USE THE TANGENT AT THE POINT TO ESTIMATE THE GRADIENT

THE RATE OF CHANGE OF TEMPERATURE AT 10 mins

$\frac{-43^\circ\text{C}}{20 \text{ mins}} = -2.15^\circ\text{C/min}$

EXPONENTIAL GROWTH

INITIALLY THERE ARE 3000 BACTERIA IN THE DISH AND THE NUMBER THEN DOUBLES EVERY HOUR

NUMBER OF BACTERIA, P

n	P
0	3,000
1	6,000
2	12,000
3	24,000
4	48,000
5	96,000
6	192,000
7	384,000
8	768,000

ITERATIVE PROCESS

NUMBER OF BACTERIA AT TIME n HOURS

$P_0 = 3000$
 $P_{n+1} = 2P_n$

$P = 3000 \times 2^n$