Direct Proportion


Direct Proportion


Inverse Proportion


Direct Proportion (Variation) Graph


Inverse Proportion (Variation) Graph


Direct Variation


Inverse Variation


Joint Variation

Understanding Formulae

In real-life we often want to see what effect changing the value of one of the variables has on the subject.

The Circumference of circle is given by the formu

$$C = \pi D$$

What happens to the Circumfer
if we double the diameter

The Circumference doubles

New D = $2D$ $C = \pi(2D) = 2\pi D$

Direct Proportion

Direct Proportion

Learning Intention

1. To explain the term Direct Proportion.

Success Criteria

1. Understand the idea of Direct Proportion.

2. Solve simple Direct Proportional problems.

Write down two quantities that are in direct proportion.

Direct Proportion

Direct Proportion

Two quantities, (for example, number of cakes and tota
o be in DIRECT Proportion, if :

Are we expecting more or less

you double the number of cakes
you double the cost."

Ex is £4.20. find the cost

Easier method

Cakes		Pence
6	⇨	420
(less) 5		

$$\frac{5}{6} \times 420 = 350 = £3.50$$

Cost
4.20
4.20 ÷ 6 = 0.70
0.70 x 5 = £3.50

Direct Propor

Direct Proport

Same ratio means in proportion

Example : Which of these pairs are in proportio

(a) 3 driving lessons for £60 : 5 for £90



(b) 5 cakes for £3 : 1 cake for 60p



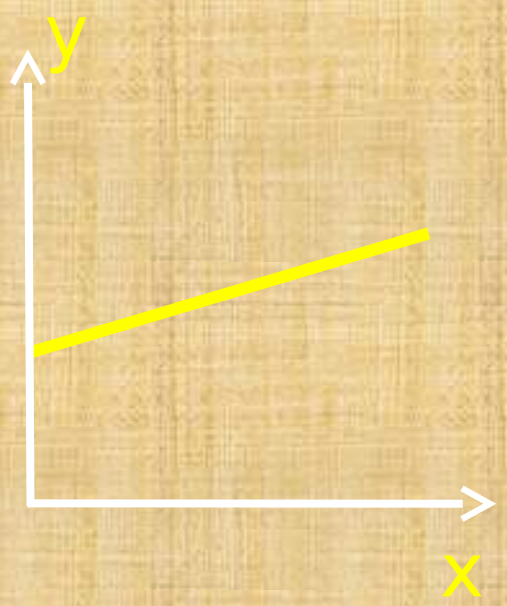
(c) 7 golf balls for £4.20 : 10 for £6

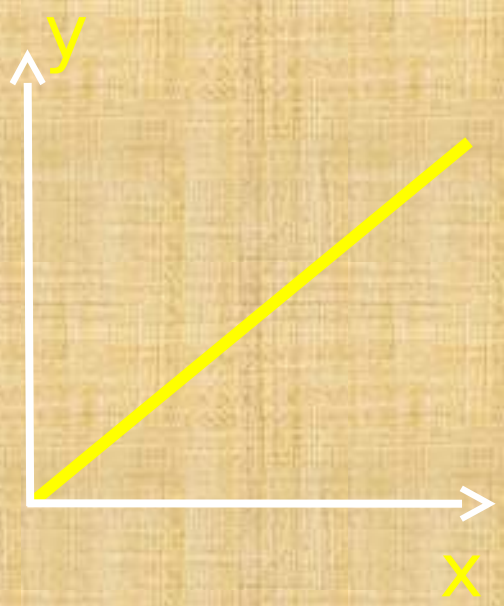


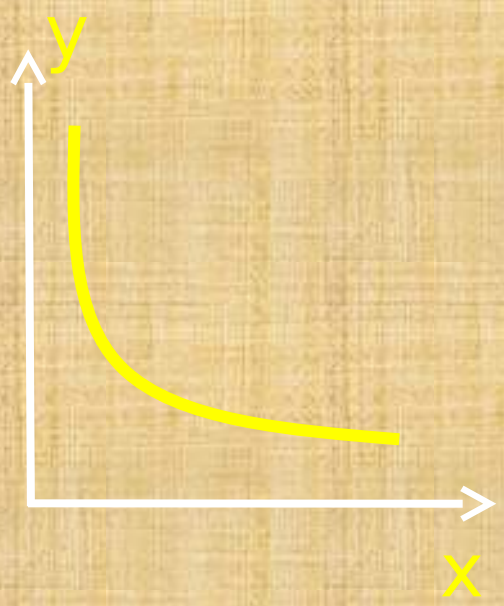
Direct Proportion

Direct Proportion

Which graph is a direct proportion graph







Inverse Proportion

Inverse Proportion

Learning Intention

1. To explain the term Inverse Proportion.

Success Criteria

1. Understand the idea of Inverse Proportion.

2. Solve simple inverse Proportion problems.

Inverse Proportion

Inverse Proportion

Inverse Proportion is when one quantity increases and the other decreases. The two quantities are said to be INVERSELY Proportional or (INDIRECTLY Proportional) to each other.

Example : Fill in the following table given x and y are inversely proportional.

X	1	2	4	8
y	80	40	20	10

Notice $x_x y = 80$
Hence inverse proportion

Inverse Proportion

Inverse Proportion

Inverse Proportion is the when one quantity increases decreases. The two quantities are said e INVERSELY Proportional RECTLY Proportional) to each other.

Are we expecting more or less

Exampl s to build a wall. . (Less time !!)

urs

x 8 = 24 hours

24 ÷ 4 = 6 hours

Easier method

Workers		Hours
3	⇨	8
(less) 4		

$$\frac{3}{4} \times 8 = 6 \text{ hours}$$

Inverse Proportion

Inverse Proportion

takes 10 men 12 months to build a house
w long should it take 8 men.

Are we expecting more or less

Men Months

120

15 months

Easier method

Workers months

10 ⇨ 12

(more) 8

$$\frac{10}{8} \times 12 = 15 \text{ months}$$

Inverse Proportion

Inverse Proportion

Are we expecting more or less

At 9 m/s a journey takes 32 minutes.
w long should it take at 12 m/s.

Speed Time

288 mins

= 24 mins

Easier method

Speed		minutes
9	⇨	32
(less) 12		

$$\frac{9}{12} \times 32 = 24 \text{ minutes}$$

Direct Proportion

Direct Proportion Graphs

Learning Intention

1. To explain how Direct Direct Proportion Graph is always a straight line.

Success Criteria

1. Understand that Direct Proportion Graph is a straight line.
2. Construct Direct Proportion Graphs.

Dire
Prop

Direct Proport

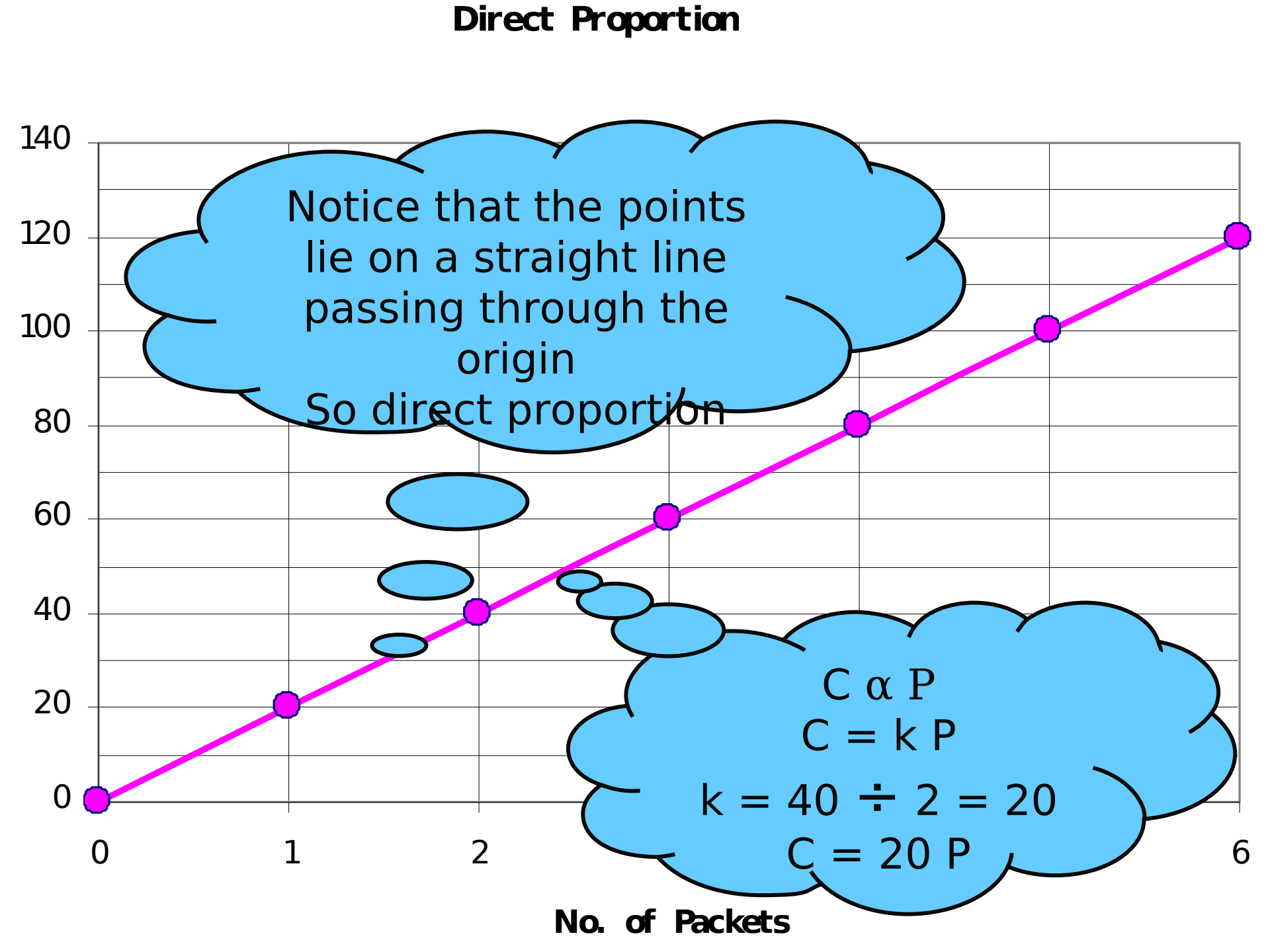
Notice C ÷ P = 20
Hence direct proportion

The table below shows the cost of packets of “Biscuits”

No. of Pkts	1	2	3	4	5	6
Cost (p)	20	40	60	80	100	120

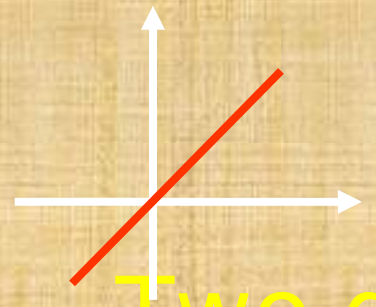
We can construct a graph to represent this data.

What type of graph do we expect ?


Direct Proportion
140
120
100
80
60
40
20
0
0
1
2
6
Notice that the points lie on a straight line passing through the origin
So direct proportion
C α P
C = k P
k = 40 ÷ 2 = 20
C = 20 P
No. of Packets

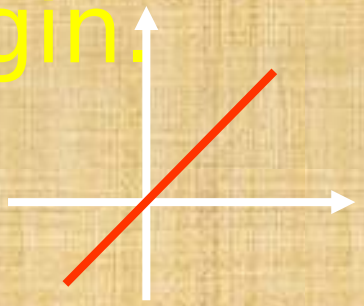
Direct Proportion

Direct Proportion Graphs



KeyPoint

Two quantities which are in Direct Proportion always lie on a straight line passing through the origin.



Direct Proportion

Direct Proportion Graphs

Ex: Plot the points in the table below.
Show that they are in Direct Proportion.
Find the formula connecting D and W ?

W	1	2	3	4
D	3	6	9	12

We plot the points (1,3) , (2,6) , (3,9) , (4,12)

Direct Proportion

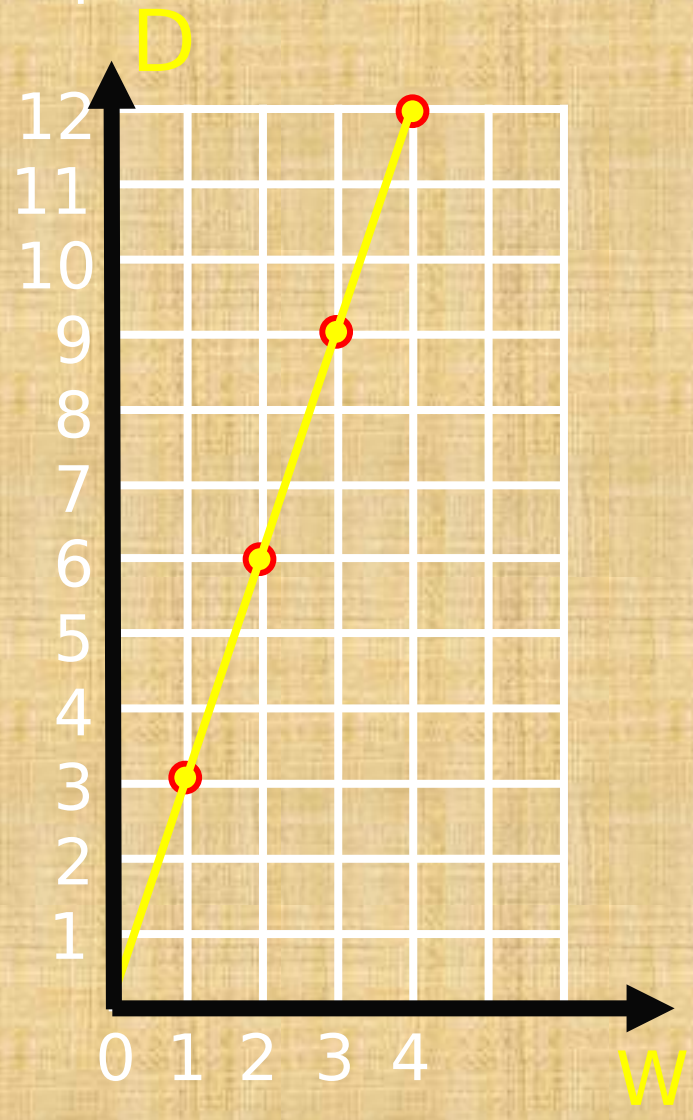
Direct Proportion Graphs

Plotting the points

(1,3) , (2,6) , (3,9) , (4,12)

Since we have a straight line passing through the origin

D and W are in Direct Proportion.



Direct Proportion

Direct Proportion Graphs

Finding the formula connecting D and W we have.

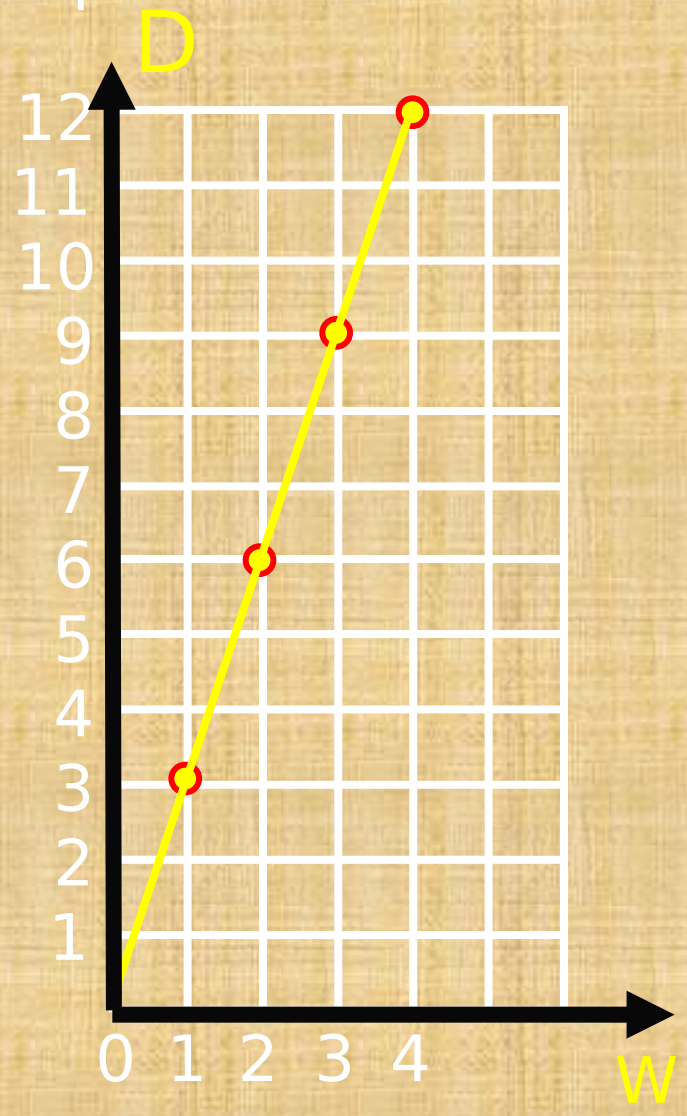
$D \propto W$

$D = 6$
$W = 2$

$D = kW$

Constant $k = 6 \div 2 = 3$

Formula is : $D = 3W$



Direct Proportion

Direct Proportion Graphs

1. Fill in table and construct graph

2. Find the constant of proportion (the k value)

3. Write down formula

Direct
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Direct P

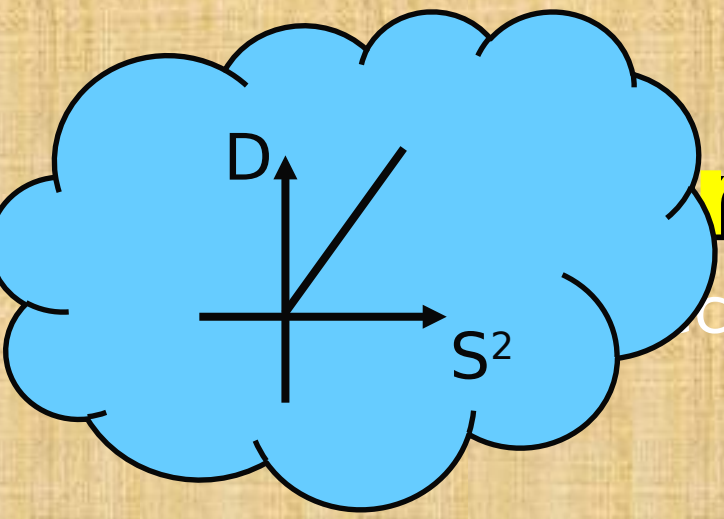
Does the distance D vary directly as speed S ?
Explain your answer

Q The distance it takes a car to brake depends on how fast it is going.

The table shows the braking distance for various speeds.

S	10	20	30	40
D	5	20	45	80

Dir
r
ct



Does D vary directly as speed, S^2 ?

Explain your answer

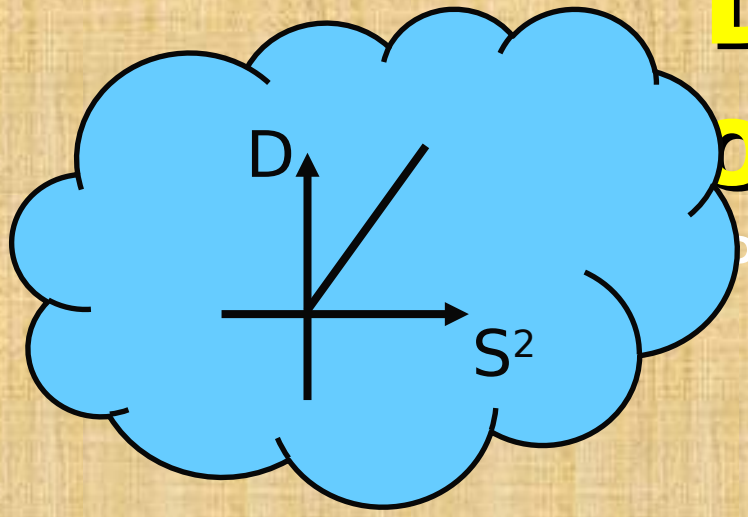
The table shows S^2 and D

S^2	100	400	900	1600
S	10	20	30	40
D	5	20	45	80

Fill in the missing S^2 values.

Direct Proportion

Proportion Graphs



Find a formula connecting D and S^2

$D \propto S^2$

$D = kS^2$

$D = 5$

$S^2 = 100$

Constant $k = 5 \div 100 = 0.05$

Formula is : $D = 0.05S^2$

Inverse Proportion

Inverse Proportion Graphs

Learning Intention

1. To explain how the shape and construction of a Inverse Proportion Graph.

Success Criteria

1. Understand the shape of a Inverse Proportion Graph .
2. Construct Inverse Proportion Graph and find its formula.

Notice W x P = £1800
Hence inverse proportion

Inverse

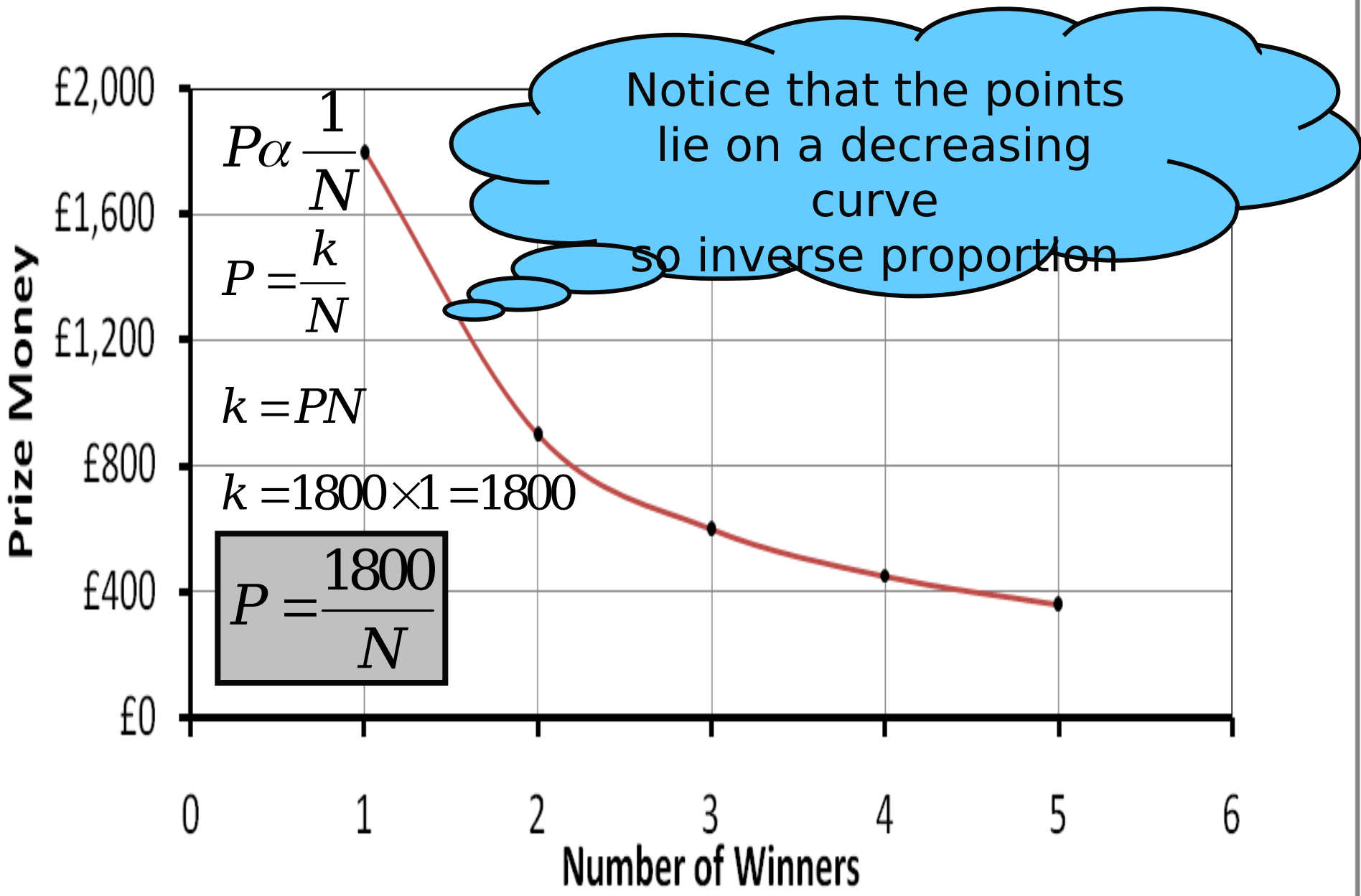
The table below shows how the total prize money of £1800 is to be shared depending on how many winne

Winners W	1	2	3	4	5
Prize P	£1800	£900	£600	£450	£360

We can construct a graph to represent this data

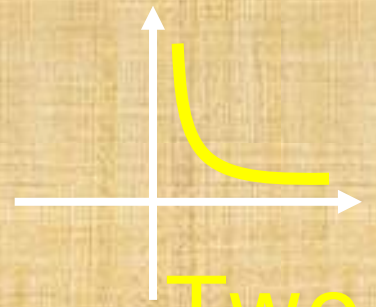
What type of graph do we expect ?

Inverse Proportion



Inverse Proportion

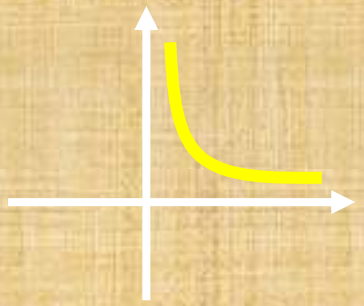
Inverse Proportion Graphs



KeyPoint

Two quantities which are in Inverse Proportion

always lie on a decrease curve



Inverse Proportion

Inverse Proportion Graphs

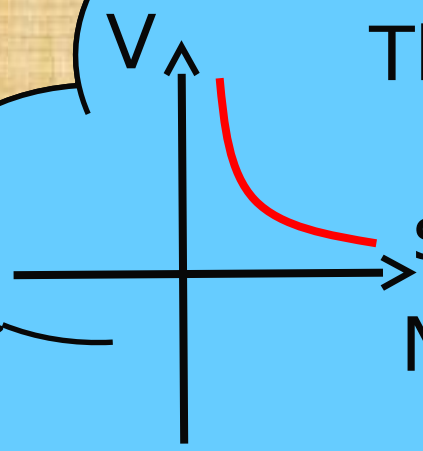
Ex: Plot the points in the table below. Show that they are in Inverse Proportion.

Find the formula connecting V and N ?

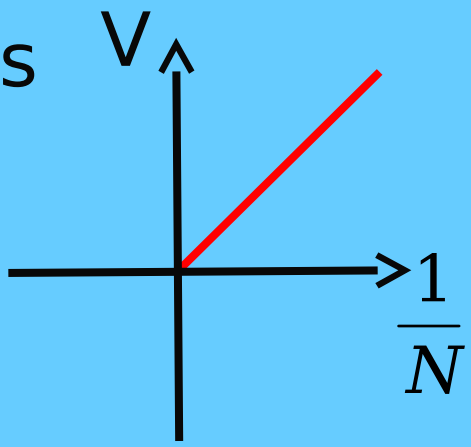
N	1	2	3	4	5
V	1200	600	400	300	240

We plot the points (1,1200) , (2,600) etc...

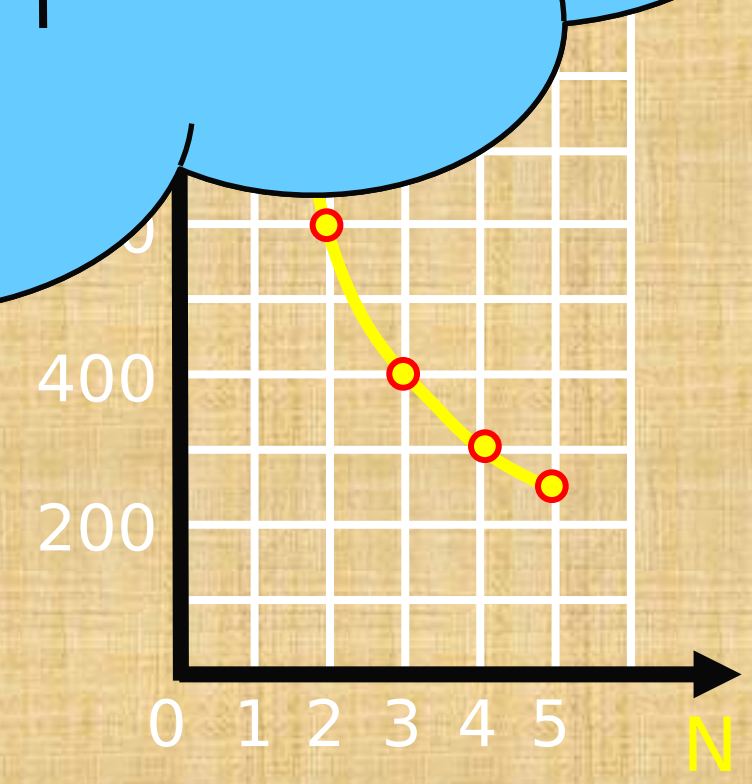
Inverse



These graphs tell us the same thing



Since the [illegible] decreasing curve V and N are in Inverse Proportion.



Inverse Proportion

Inverse Proportion Graphs

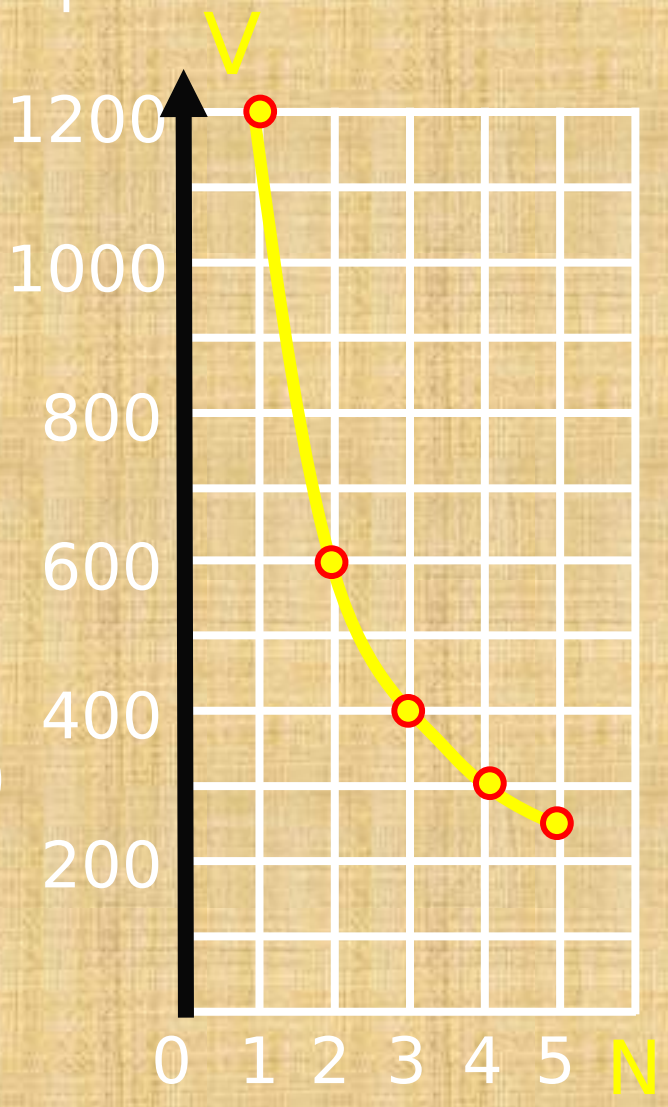
Finding the formula connecting V and N we have.

$$V \alpha \frac{1}{N} \qquad V = \frac{k}{N}$$

V = 1200
N = 1

k = VN = 1200 x 1 = 1200

$$V = \frac{1200}{N}$$



Direct Proportion

Direct Proportion Graphs

1. Fill in table and construct graph

2. Find the constant of proportion (the k value)

3. Write down formula

Direct Variation

Learning Intention

1. To explain how to work out direct variation formula.

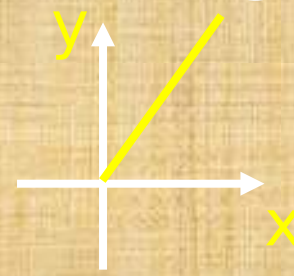
Success Criteria

1. Understand the process for calculating direct variation formula.

2. Calculate the constant k from information given and write down formula.

Direct Variation

Given that y is directly proportional to x,
and when y = 20, x = 4.
Find a formula connecting y and x.



Since y is directly proportional to x
the formula is of the form

$y = kx$

k is a constant

$20 = k(4)$

$y = 20k = 20 \div 4 = 5$

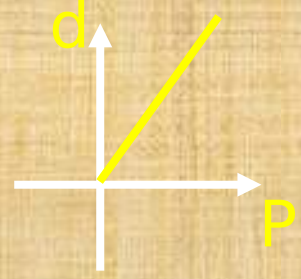
$x = 4$

$y = 5x$

Direct Variation

The number of dollars (d) varies directly as the number of £'s (P). You get 3 dollars for £2. Find a formula connecting d and P.

Since d is directly proportional to P the formula is of the form



$d = kP$

$3 = k(2)$

$d = 3$ $k = 3 \div 2 = 1.5$

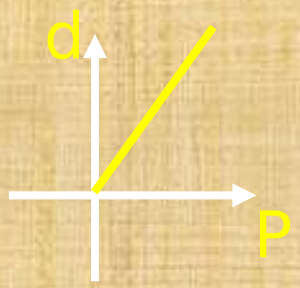
$P = 2$

$d = 1.5P$

k is a constant

Direct Variation

Q. How much will I get for £20



$d = 1.5P$

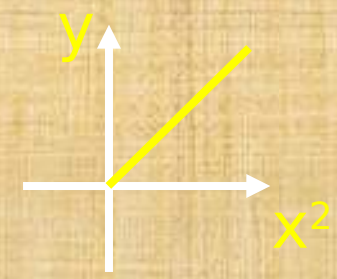
$d = 1.5 \times 20 = 30$ dollars

Direct Variation

Harder Direct Variation

Given that y is directly proportional to the square of x, and when y = 40, x = 2.
Find a formula connecting y and x .

Since y is directly proportional to x squared the formula is of the form



$$y = kx^2$$

$$40 = k(2)^2$$

$$k = 40 \div 4 = 10$$

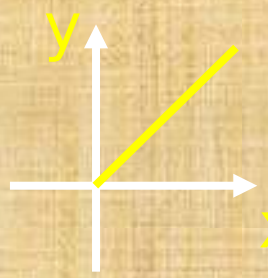
$y = 40$
$x = 2$

$$y = 10x^2$$

Direct Variation

Harder Direct Variation

Q. Calculate y when x = 5



$$y = 10x^2$$

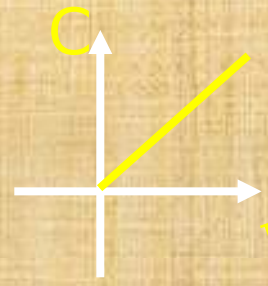
$$y = 10(5)^2 = 10 \times 25 = 250$$

Direct Variation

Harder Direct Variation

Q. The cost (C) of producing a football magazine varies as the square root of the number of pages (P). Given 36 pages cost 48p to produce. Find a formula connecting C and P.

Since C is directly proportional to "square root of" P the formula is of the form



$$C = k\sqrt{P}$$

$$48 = k\sqrt{36}$$

C = 48
P = 36

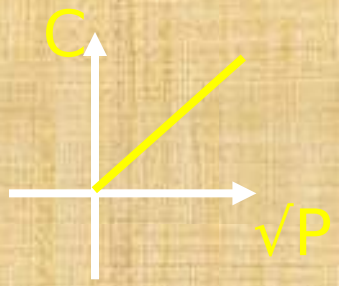
k = 48 ÷ 6 = 8

$$C = 8\sqrt{P}$$

Direct Variation

Harder Direct Variation

Q. How much will 100 pages cost.



$$C = 8\sqrt{100}$$

$$C = 8\sqrt{100} = 8 \times 10 = 80p$$

Inverse Variation

Learning Intention

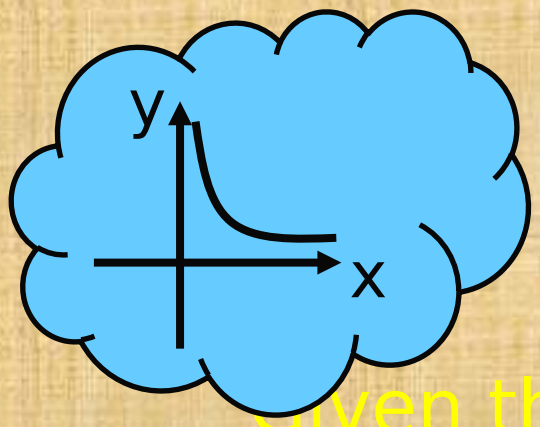
1. To explain how to work out inverse variation formula.

Success Criteria

1. Understand the process for calculating inverse variation formula.

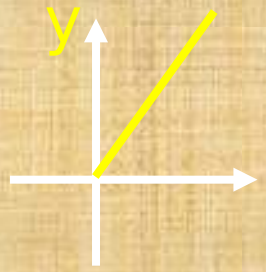
2. Calculate the constant k from information given and write down formula.

Inverse Variation



Given that y is inverse proportional to x, and when y = 40, x = 4.
Find a formula connecting y and x.

Since y is inverse proportional to x the formula is of the form



$$y \propto \frac{1}{x} \qquad y = \frac{k}{x}$$

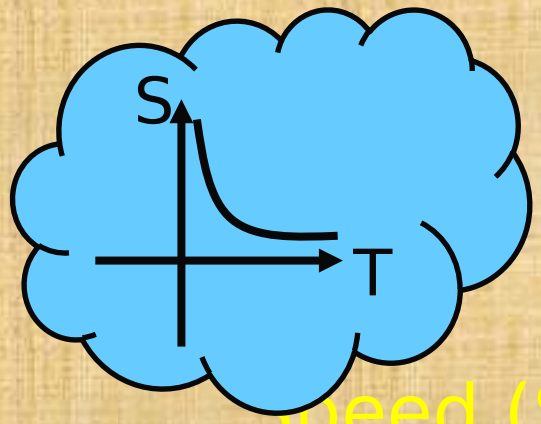
k is a constant

y = 40 x = 4

$k = 40 \times 4 = 160$

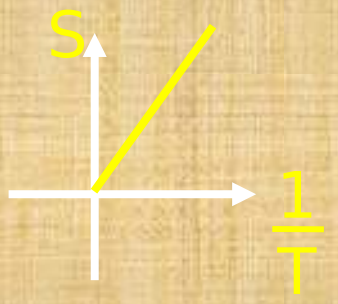
$$y = \frac{160}{x}$$

Inverse Variation



Speed (S) varies inversely as the Time (T)
When the speed is 6 kmph the Time is 2 hours Find a formula connecting S and T

Since S is inversely proportional to T the formula is of the form



$$S \propto \frac{1}{T} \qquad S = \frac{k}{T}$$

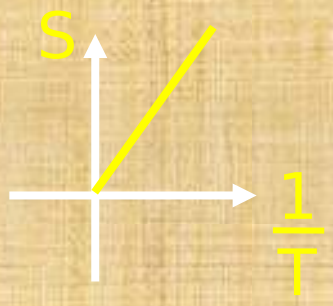
k is a constant

S = 6 k = 6 x 2 = 12
T = 2

$$S = \frac{12}{T}$$

Inverse Variation

Find the time when the speed is 24mph.

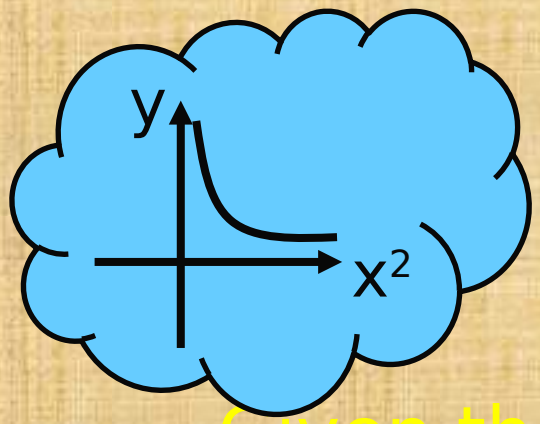


S = 24
T = ?

$$S = \frac{12}{T}$$

$$24 = \frac{12}{T}$$

$$T = \frac{12}{24} = 0.5\ hours$$

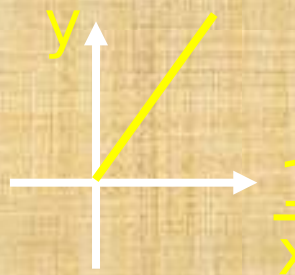


Inverse Variation

Harder Inverse variation

Given that y is inversely proportional to the square of x, and when y = 100, x = 2.
Find a formula connecting y and x .

Since y is inversely proportional to x squared the formula is of the form



$$y \propto \frac{1}{x^2} \qquad y = \frac{k}{x^2}$$

k is a constant

y = 100 k = 100 x 2² = 400

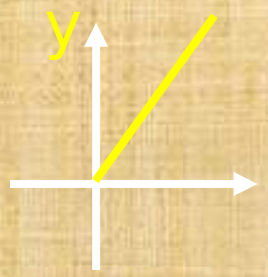
x = 2

$$y = \frac{400}{x^2}$$

Inverse Variation

Harder Inverse variation

Q. Calculate y when x = 5



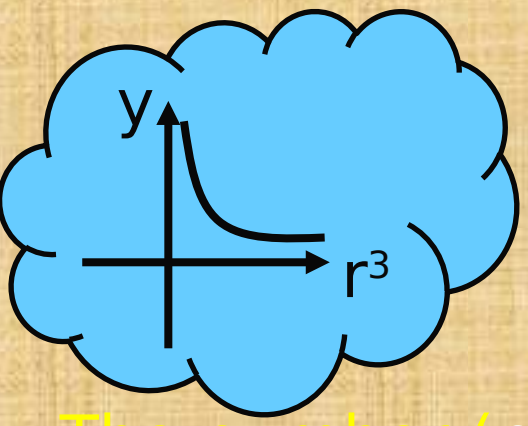
y = ?

x = 5

$$y = \frac{400}{x^2}$$

$$y = \frac{400}{5^2}$$

$$y = 16$$

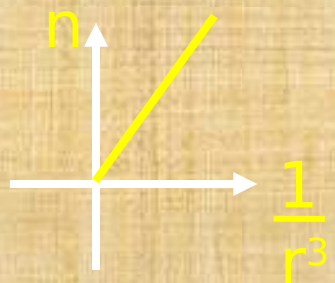


Inverse Variation

Harder Inverse variation

The number (n) of ball bearings that can be made from a fixed amount of molten metal varies inversely as the cube of the radius (r). When r = 2mm ; n = 168
Find a formula connecting n and r.

Since n is inversely proportional to the cube of the formula is of the form



$$n \propto \frac{1}{r^3}$$

$$n = \frac{k}{r^3}$$

k is a constant

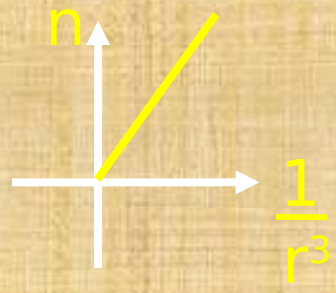
n = 100k = 168 x 2^3 = 1344
r = 2

$$n = \frac{1344}{r^3}$$

Inverse Variation

Harder Inverse variation

How many ball bearings radius 4mm can be made from the this amount of metal.



r = 4

$$n = \frac{1344}{4^3}$$

$$n = 21$$

Inverse Variation

T varies directly as N and inversely as S
Find a formula connecting T, N and S
given T = 144 when N = 24 S = 50

Since T is directly proportional to N
and inversely to S the formula is of the form

$$T \propto \frac{N}{S} \qquad T = \frac{kN}{S}$$

k is a constant

T = 144
N = 24
S = 50

k = 144 x 50 ÷ 24 = 300

$$T = \frac{300N}{S}$$