CHAPTER 2

Patterns, Relationships And Representations

CONTENTS

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MathU Teaching® Emporium

1 PATTERNS AND RELATIONSHIPS

1.1 Exercises 12: Patterns and Relationships

Complete the following tables:

1.

Number of workers	2	4	6	8		16	
Time in hours	162	81		40.5	27		13.5

Is this an example of direct or indirect proportion? What is the formula?

2.

Mass of sweets in kg	1	2	4		8		19
Price in Rand	20		80	140		220	

Is this an example of direct or indirect proportion? What is the formula?

3. A model aeroplane is made to a scale of 1:50

Length on the model		24cm		12cm	
Length on the plane	35m		10m		

Is this an example of direct or indirect proportion?

4. The exchange rate of $ versus R is $1 : 8.50$

$	25		208	
R		205,56		30 000

Is this an example of direct or indirect proportion? What is the formula?

5. The table below shows the amount of time that the workers need to clean the Gautrain. This train needs to be cleaned every day.

Number of workers	1	2	3	5	
Time in minutes	210				14

Is this an example of direct or indirect proportion? What is the formula?

6. The table below shows the number of persons that share the cost to drive to work and back in a week. Round your answers to the nearest cent.

Number of persons	Driver only	2	3	4	5
Rand per person	R1 450.00				

Is this an example of direct or indirect proportion? What is the formula?

2 REPRESENTATION OF DIRECT PROPORTION

Two quantities are in **direct proportion** if the rate remains the same and when **the one quantity increases, the other also increases**. If the one quantity is zero, the other quantity is also zero. (That means that the graph goes through the origin and the shape of the graph is a straight line.)

2.1   Exercise 13: Direct Proportion (Graph)

1. The table illustrates the fuel consumption (litre) for distance (km) covered by a motorcycle. Complete the table and represent graphically, with distance covered on the horizontal axis.

 | Distance covered (km) | 0 | 100 | 200 | | 400 | | 500 |
   |-----------------------|---|-----|-----|----|-----|----|-----|
   | Petrol consumption (l) | 0 | 8 | | 24 | | 40 | |

   Use your graph to answer the next questions.
   Show on the graph where you read your answer from.

2. How much petrol will be consumed to cover 150km?

3. How much petrol will be consumed to cover 225km?

4. What distance can be covered with 12l of petrol?

5. What distance can be covered with 28l of petrol?

6. If the fuel costs R12.00 per litre and R170.00 is available, what distance can be covered?

7. What is the constant ratio between petrol consumption and distance covered?

> **Study the graph beneath!**
>
> A typical linear curve
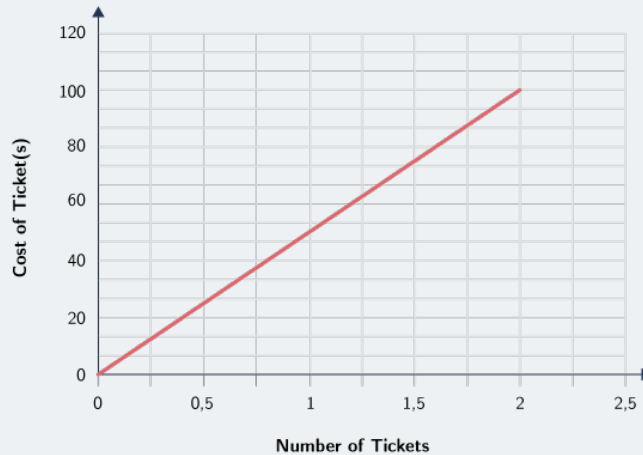
3 REPRESENTATION OF INDIRECT/INVERSE PROPORTIONS

The quantities are in **inverse proportion** if the **product** of the quantities is constant and the value of one quantity **increases** when the value of the other quantity **decreases**. Neither one of the quantities can be zero.

3.1 Exercises 14: Indirect/Inverse Proportions (Graph)

1. To complete the construction of a stretch of road, it takes 60 men 6 days. If only 30 men are available, it will take 12 days to complete the project. The relationship between the number of days and the available men is illustrated in the table:

   Complete the table below

Number of days	6	9			36	
Number of men	60		30	20	10	2

2. Illustrate the tabled information graphically, with the number of men in the horizontal axis.

3. Determine: (Read from the graph and show where you did the reading)

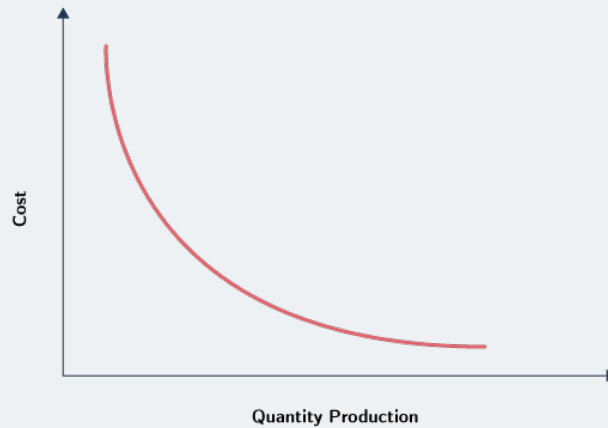3.1 The number of days needed if 45 men are available?

3.2 how many men will be needed if the project is to be completed in 26 days?

4. Complete: the more men available, the _____ the project can be completed.

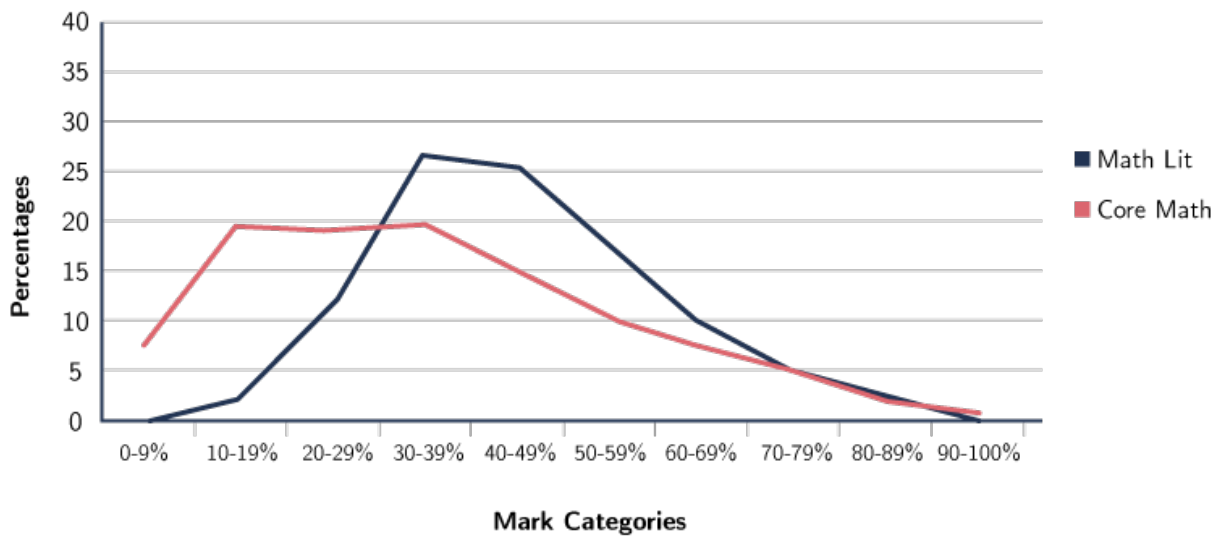5. What is the proportional constant?

Remember this!

A typical average cost curve

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4 WORKING WITH TWO OR MORE RELATIONSHIPS AND/OR REPRESENTATIONS

4.1 Exercises 15: Multiple Relationships

1. The graph below shows a performance distribution of Mathematical Literacy versus Core Mathematics. Study the graph and answer the following questions.

1.1 Do you think the Math Lit exam papers are easy and below standard?(Discuss)

1.2 Which of the two subjects has percentage wise the most candidates with distinctions? Prove your answers with readings from the graph.

1.3 Compare the percentage of learners that fail in the two different subjects. Prove your answers with readings from the graph.

1.4 Would you recommend a friend to take Math Lit as a subject? Motivate your answer.

2. Multiple Relationships – Population Pyramid

Male   **United States - 2012**   **Female**

Population (in Millions)   Age Group   Population (in Millions)
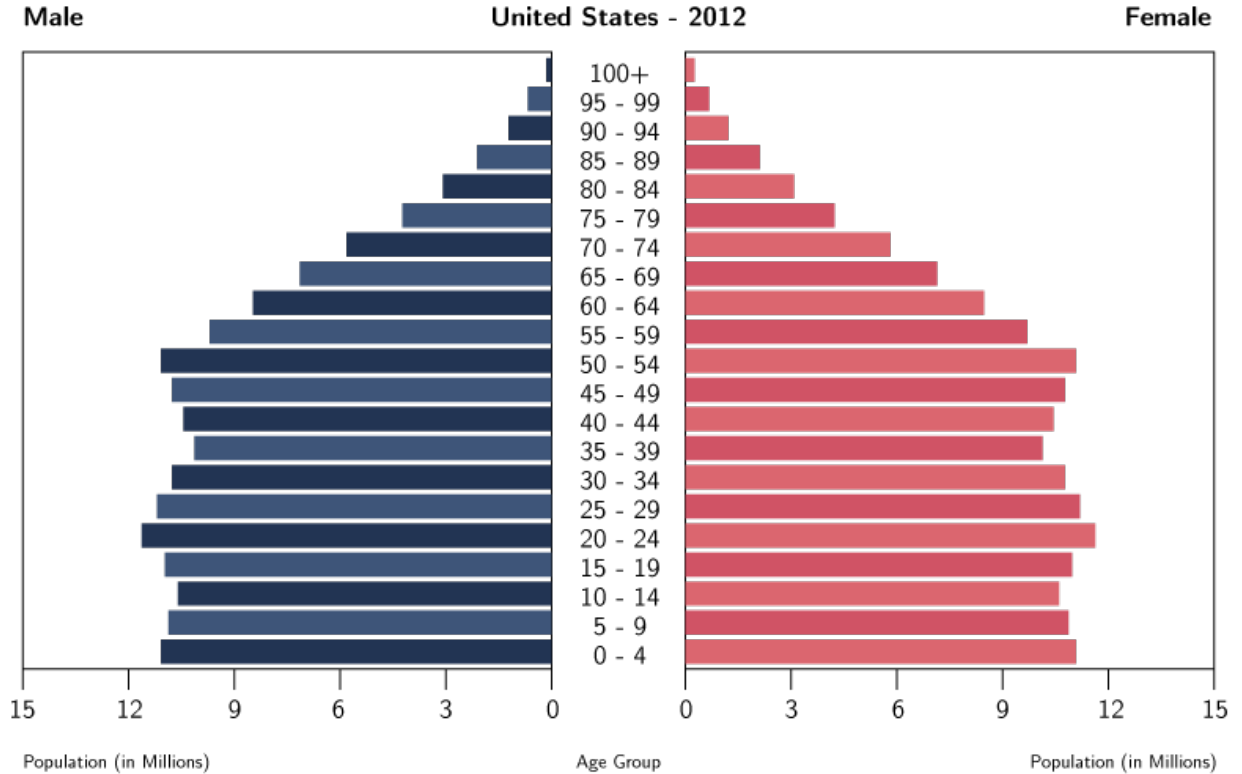
2.1 What age group has the most males?

2.2 What age group has the most females?

2.3 According to this bar graph, what gender has more old aged people?

2.4 What gender has the most people?

2.5 Why do you think there are less people between the ages of 35 to 39?

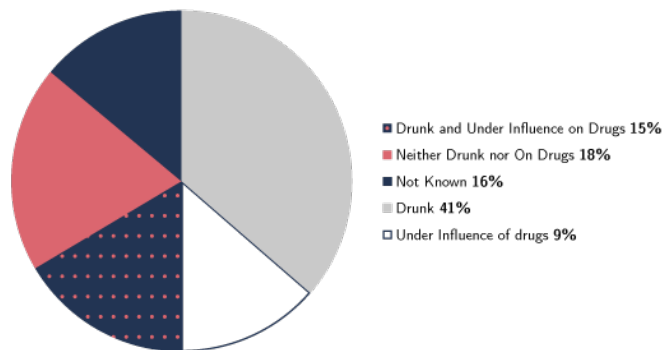3. Multiple Relationships – Line Graphs and Pie Charts

Number of Arrests, by Drug Type, 1982 - 2007
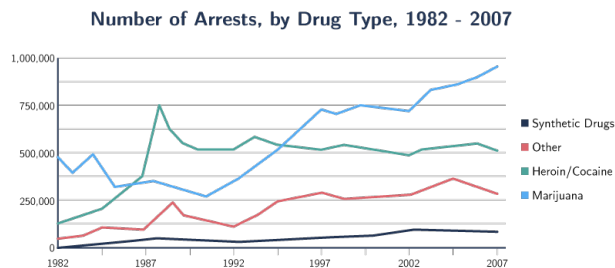
3.1 What was the most popular drug in 1982, according to arrests?

3.2 What was the peak number of arrests between 1987 and 1992? What drugs did they use?

3.3 Between 1992 and 1997 there was an equal number of arrests. What were the drugs?

3.4 How many arrests were there at break-even point?

3.5 What was the difference in the number of arrests between Marijuana and Heroin in 1982?

3.6 Is there a positive or negative growth in the number of arrests since 1982?

4.

Deaths From Drug Misuse
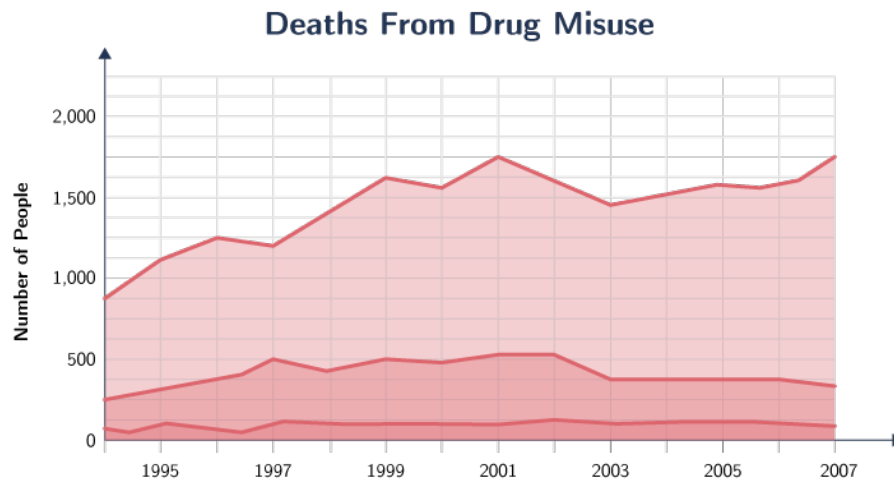
4.1 In what year did the most deaths from drug misuse occur?

4.2 How many people died in that year?

4.3 Around $206\,000$ of these problem drug users received some kind of rehab treatment in $2009 - 2010$. Around $62\,600$ completed some form of treatment, but only $8\,112$ left entirely drug free. What is the success rate? Give your answer as a percentage.

4.4 However, a further $15\,568$ left still using drugs, but were defined as "dependence free". What is your view on this? Do you think one can use drugs "dependence free"?

- Drunk and Under Influence on Drugs **15%**
- Neither Drunk nor On Drugs **18%**
- Not Known **16%**
- Drunk **41%**
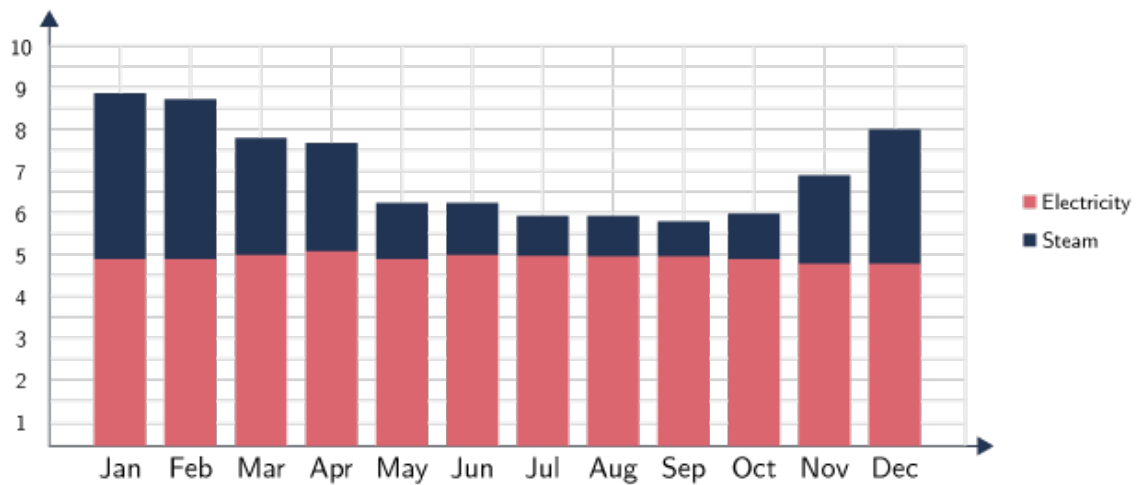- Under Influence of drugs **9%**

   4.5 How many accused people were drunk?

   4.6 How many people were under the influence of drugs?

   4.7 What is the difference between alcohol misuse and drug misuse according to this pie chart?

5. Multiple Relationships – Bar and Line Graphs Interpret the following graphs:
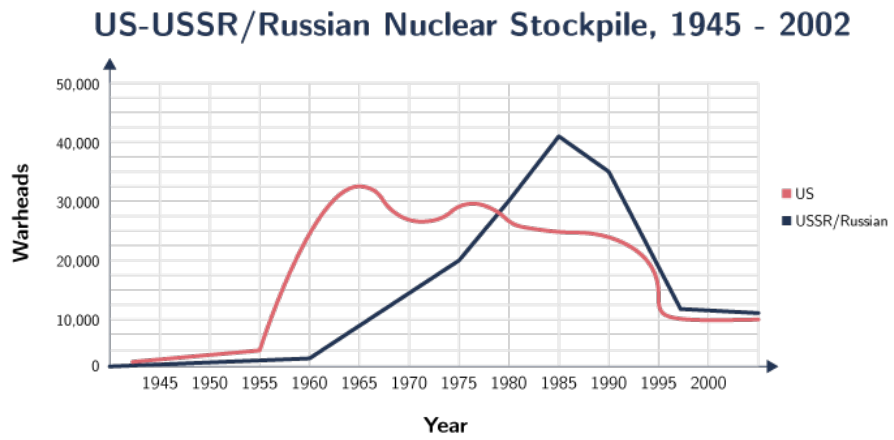

   5.1 In what month was the most energy used?

   5.2 In what month was the least energy used?

   5.3 In what month was the least steam used?

5.4 In what month was the most electric energy used?

US-USSR/Russian Nuclear Stockpile, 1945 - 2002

5.5 During what year(s) did the US and the USSR have the same number of nuclear stockpile?

5.6 During what year did the US have the most Nuclear Stockpile?

5 ANSWERS TO EXERCISE

5.1 Exercise 12

1. Indirect proportion. Number of workers $= \frac{324}{Time\ in\ hours}$

2. Direct proportion. Mass $\times 20 = Price\ in\ Rand$

3.

Length on the model	75cm	24cm	20cm	12cm
Length on the plane	35m	12m	10m	6m

Direct proportion.

4.

$	25	$23,83$	208	$3529,41$
R	$212,50$	$205,56$	1768	30 000

Direct proportion. $R = 8,5 \times \$$

5.

Number of workers	1	2	3	5	15
Time in minutes	210	105	70	42	14

Indirect proportion. Number of workers $= \frac{210}{Time\ in\ min.}$

6.

Number of persons	Driver only	2	3	4	5
Rand per person	R1 450.00	R725	$R483,33$	$R362,50$	R290

Indirect proportion. Rand per person $= R\ 1450\frac{}{Number\ of\ persons\ sharing}$

Direct Proportion Graph
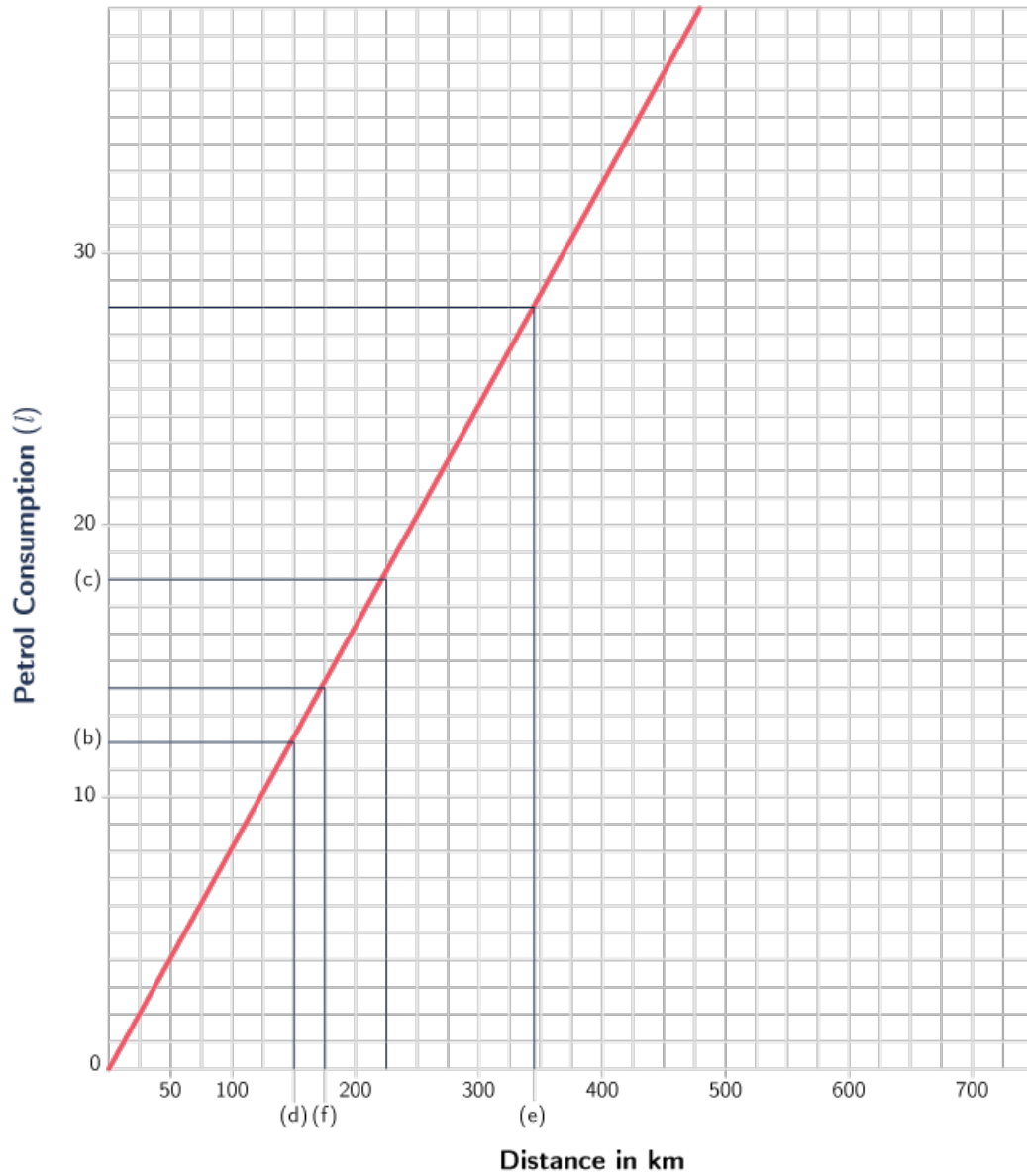
1.

Distance covered (km)	0	100	200	300	400		500
Petrol consumption (l)	0	8	16	24	32	40	

2. 12l

3. 18l

4. 150km

5. nearly 350km

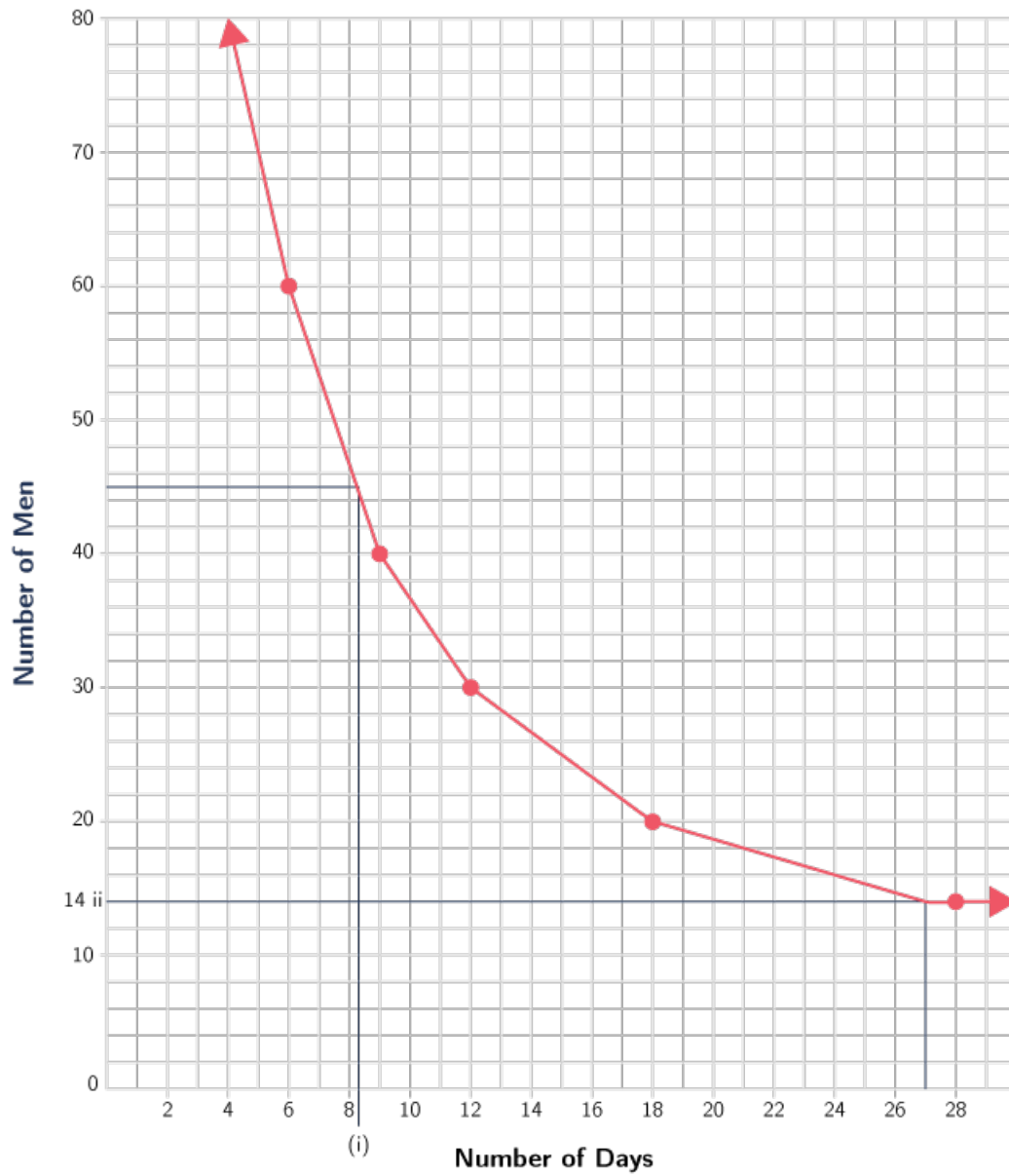6. $\frac{170}{12} = 14,167$km $\therefore$ 17km (Read from graph)(f)

7. $12,5$km/l

5.3   Exercise 14

1.

Number of days	6	9	12	18	36	180
Number of men	60	40	30	20	10	2

Inverse Proportion Graph

2.

3.1 8 days

3.2 14 men

4. less days

5. 360

5.4   Exercise 15

1.1 No, if you compare the distinctions, Math Lit has less distinctions than core Math! From 70% and up, the two subjects are more or less equal if it comes to distinctions.

1.2 In Core Maths more learners achieved between $90 - 100$%. In Math Lit more learners achieved between $70 - 89$%

1.3

	Lit	Core
$0 - 9$%	0%	6%
$10 - 19$%	3%	18%
$20 - 29$%	10%	18%
$30 - 39$%	26%	19%

1.4 Math Lit is a very important subject to help learners once they finish with school. E.g.

- Financial Math: important that you are able to budget and calculate your tax
- To do calculations when you go shopping and even when you want to buy a house or car
- When you travel it is important that you know the time difference and the different currencies
- Measurements: To paint and to buy tiles, bricks etc.

2.1 $20 - 24$

2.2 $50 - 54$

2.3 Female

2.4 Female

2.5 People live risky life-styles in this age group.

3.1 Marijuana

3.2 705000 Heroin/cocaine

3.3 Marijuana and Heroin/cocaine

3.4 625000 of both

3.5 $\approx 500000 - 125000 = 375000$

3.6 All over a positive growth, except Heroin

4.1 2001

4.2 1750

4.3 $\frac{8112}{206000} \times 100 = 3,94\%$ Drug free

4.4 One can't be "dependence free", when still using drugs.

4.5 $41\% \times 138 = 56,58 \approx 57$ of the accused.

4.6 $15\% + 9\% = 24\%$
$24\% \times 138 = 33$ people

4.7 Drunk $41\% + 15\% = 56\%$
$56\% \times 138 = 77$ people
Difference $77 - 33 = 44$ more people under the influence of alcohol.

5.1 January

5.2 September

5.3 September

5.4 April

5.5 1978 and 2003

5.6 1966