



Junior Cert Maths Notes
Sample
Paper 1
(Higher Level)

by

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Number Theory

1. Conversions.

First let's take a look at some simple conversions.

1kg=1000grams

1litre=1000ml

1metre=100centimetres

1km=1000metres=100000centimetres

1minute=60seconds

1hour=60minute=3600seconds

1.1

Express 45 centimetres as a fraction of 15 metres and write your answer in its simplest form.

Express everything in centimetres

15metres= 1500centimetres

$$\frac{45}{1500} = \frac{3}{100} = 0.03$$

1.2

Given that the speed of sound in air is 330 metres per second, express this speed in km/hr

Change metres to kilometres and then seconds to hours

$$\frac{330}{1000} = 0.33 \text{ kilometres per second}$$

$$0.33 \times 60 \times 60 = 1188\text{km/hr}$$

1.3

Express 320 grams as a fraction of 8kg

$$\frac{320}{8000} = \frac{1}{25} = 0.04$$

2. Rounding Off

Firstly it's important to remember in what order we multiply, add, subtract, etc...

The order is

1. Brackets
2. Exponents (Roots and Powers)
3. Multiply or Divide
4. Add or subtract

Some people like to remember the word BEMDAS to help remember the order (Brackets Exponents Multiply Divide Add Subtract)

When rounding correct to the nearest whole number, we pay attention to the first decimal place. If it is 5 or greater we round it up to the nearest whole number. If it is less than 5 we round it down to the nearest whole number.

Look at the first decimal place

- 6.8 8 is greater than 5. Round up to 7.0
 9.2 2 is less than 5. Round down to 9.0
 5.5 If 5 is in the first decimal place we round up. Round up to 6.0

When rounding correct to one decimal place. We pay attention to the second decimal place

- 7.72 2 is less than 5. Round down to 7.70
 16.89 9 is greater than 5. Round up to 16.90
 4.55 5 is in the second decimal place so we round up. Round up to 4.60

Rounding off to 3 or 4 decimal places is done the exact same way

2.1

(i) By rounding correct to the nearest whole number, estimate the value of

$$\frac{3.8}{4.23} + (2.97)^3 \div \sqrt{9.16}$$

$$\frac{4}{4} + (3)^3 \div \sqrt{9}$$

$$1 + 27 \div 3$$

Divide before adding

$$1 + 9 = 10$$

(ii) Then, evaluate $\frac{3.8}{4.23} + (2.97)^3 \div \sqrt{9.16}$

correct to one decimal place.

We get

$$0.8983 + 26.198 \div 3.0265$$

Again divide first

$$0.8983 + 8.6562 = 9.554$$

Correct to one decimal place

$$= 9.6$$

2.2

(i) By rounding to the nearest whole number, estimate the value of

$$\frac{131.5 - 1.73 \times \sqrt{0.64}}{35.4 - (5.1)^2}$$

By rounding off we get

$$\frac{132 - 2 \times \sqrt{1}}{36 - (5)^2}$$

$$= \frac{130}{11}$$

$$= 11.818$$

$$= 11.82$$

(ii) Then, evaluate correct to two decimal places.

$$\frac{131.5 - 1.73 \times 0.8}{35.4 - 26.01}$$

Multiply before we subtract

$$\frac{131.5 - 1.384}{35.4 - 26.01}$$

$$= \frac{130.116}{9.39}$$

$$= 13.856869$$

Correct to two decimal places

$$= 13.86$$

2.3

Wendy estimates the value of $527 + 889 + 436$ by rounding to the nearest 100. Find the estimated value.

$$\text{Round off } 527 = 500$$

$$\text{Round off } 889 = 900$$

$$\text{Round off } 436 = 400$$

$$500 + 900 + 400 = 1800$$

3. Average Speed and Fuel Consumption

$$\text{Average Speed} = \frac{\text{Distance}}{\text{Time}}$$

To change a time longer than an hour into a decimal, express the Total time in minutes and divide by 60

2 hours 30 mins = 150 mins

$$\frac{150}{60} = 2.5$$

1 hour 45 mins = 105 mins

$$\frac{105}{60} = 1.75$$

3 hours 20 mins = 200 mins

$$\frac{200}{60} = 3.33$$

$$\text{Fuel Consumption} = \frac{\text{Number of kilometres travelled}}{\text{Kilometres per litre}}$$

3.1

(i) A man travels from Arklow to Blanchardstown, a distance of 90 km. He leaves Arklow at 09:25 and arrives in Blanchardstown at 10:55. Calculate his average speed for the journey.

Time = 10.55 – 09.25 = 1 hour 30 mins

1 hour 30 mins = 90 mins

$$\frac{90}{60} = 1.5$$

Time = 1.5 hours

$$\text{Average Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\text{Average Speed} = \frac{90}{1.5} = 60\text{km/hr}$$

(ii) He continues from Blanchardstown to Cootehill, a distance of 112 km. He increases his average speed by 4 km/hr for this section of his journey. At what time does he arrive in Cootehill?

$$\text{Average Speed} = 60+4 = 64\text{km/hr}$$

Rearrange the formula so we have

$$\text{Time} = \frac{\text{Distance}}{\text{Average Speed}}$$

$$\text{Time taken} = \frac{112}{64} = 1.75$$

$$1.75 = 1 \text{ hour } 45 \text{ mins}$$

3.2

Car A and Car B set off from a starting point S at the same time. They travel the same route to destination D, which is 70 km away. Car A travels at an average speed of 50 km/h and car B travels at an average speed of 45 km/h. How far will car B have travelled by the time car A arrives at destination D?

Car A and Car B travel for the same amount of time.

Rearrange the formula so we have

$$\text{Time} = \frac{\text{Distance}}{\text{Average Speed}}$$

Car A

$$\text{Time taken} = \frac{70}{50} = 1.4 \text{ hours}$$

Car B

$$1.4 = \frac{\text{Distance}}{45}$$

$$\text{Distance} = 45 \times 1.4$$

$$\text{Distance} = 63\text{km}$$

3.3

The time taken by Jack to travel from Derry to Waterford, a distance of 378 km, is 6 hours. His return journey from Waterford to Derry, by the same route, takes an extra 45 mins.

By how many km/hr is his average speed slower on the return journey?

$$\text{Average Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\text{Average Speed} = \frac{378}{6}$$

$$\text{Average Speed} = 63 \text{ km/hr}$$

$$\text{Time for return journey} = 6 \text{ hours } 45 \text{ mins} = 405 \text{ mins}$$

$$\frac{405}{60} = 6.75$$

$$\text{Average Speed} = \frac{378}{6.75}$$

$$\text{Average Speed} = 56\text{km/hr}$$

By how much is he slower?

$$63 - 56 = 7\text{km/hr}$$

3.4

(i) A car journey of 455 kilometres took 6 hours and 30 minutes. Calculate the average speed of the car, in km/hr, for the journey.

$$\text{Average Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\text{Average Speed} = \frac{455}{6.5} = 70\text{km/hr}$$

(ii) If the average petrol consumption for the journey was 9.2 kilometres per Litre, calculate the number of litres used, correct to the nearest litre.

$$\text{Fuel Consumption} = \frac{\text{Number of kilometres travelled}}{\text{Kilometres per litre}}$$

$$\text{Fuel Consumption} = \frac{455}{9.2} = 49.45 \text{ litres}$$

Correct to the nearest litre 49 litres

3.5

**Fuel consumption in a car is measured in litres per 100 km.
Alan's car travels 1250 km on a tank of 68 litres.
Calculate his car's fuel consumption in litres per 100 km.**

In this case the formula does not apply as we are calculating litres per 100km rather than kilometres per litre

$$\frac{1250}{100} = \text{How many times we've travelled 100km}$$

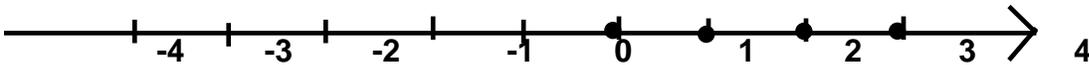
$$12.5 = \text{How many times we've travelled 100km}$$

$$\frac{68}{12.5} = 5.44$$

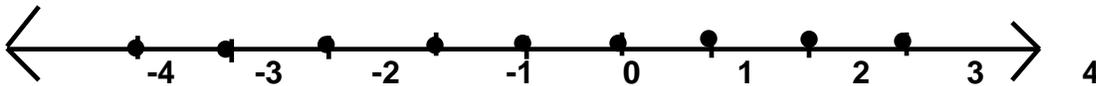
5.44 litres are used per 100km

4. Number Line

N - The Natural numbers. This is the set of positive whole numbers i.e. 1,2,3,4,5.....etc



Z – The Integers. This is the set of negative and positive whole numbers which includes 0 i.e. ...-3,-2,-1,0,1,2,3...



R – The Real Numbers. This consists of all the numbers on the number line



Q – The set of rational numbers. This is any number that can be expressed as a fraction.



Numbers that are not rational are irrational and are denoted $\mathbb{R} \setminus \mathbb{Q}$. Irrationals cannot be expressed as fractions. Irrationals have an infinite amount of decimal places. A good example of this is π .

Since $\pi = 3.14159\dots$ etc it has an infinite amount of decimal places, it is irrational

Another good example is a root such as $\sqrt{7}$ or $\sqrt{13}$. They cannot be expressed as fractions and have an infinite amount of decimal places, therefore they are irrational.

Take x to be any number

If $x \in \mathbb{N}$ then x is a Natural number

If $x \in \mathbb{Z}$ then x is an Integer

If $x \in \mathbb{R} \setminus \mathbb{Q}$ then x is Irrational

If $x \in \mathbb{Q}$ then x is a Rational number

If $x \in \mathbb{R}$ then x is a Real number

4.1

Give two reasons why $-7 \cdot 3$ is not a natural number.

1. It's not positive
2. It's not a whole number

4.2

Why is 7.41 not an irrational number.

It can be expressed as a fraction $\frac{741}{1000}$ so it is a rational number.

Since it is rational it cannot be irrational

4.3

Under what sets of numbers does zero comes under?

0 is not a Natural number. The natural numbers start at 1 i.e 1,2,3,4,5...

0 is an Integer

0 is Rational as it can expressed as $\frac{0}{1}$

0 is Rational so it is not Irrational

0 is Real as it is on the number line

4.4

State which set of numbers (Natural numbers, Integers etc...) the following numbers come under $\sqrt{5}$, 8, 3.5, - 4 , π

$\sqrt{5}$ - Not Natural, Not an Integer, Not Rational, Real and Irrational $\in \mathbb{R}, \mathbb{R} \setminus \mathbb{Q}$
It is on the number line and it has an infinite amount of decimal places

8 – Natural, Integer, Rational, Real, Not Irrational $\in \mathbb{N}, \mathbb{Z}, \mathbb{Q}, \mathbb{R}$
Whole number that's positive and on the number line

3.5 – Not Natural, Not an Integer, Rational, Real and Not Irrational $\in \mathbb{Q}, \mathbb{R}$
Not a whole number, can be expressed as a fraction and is on the number line

-4 - Not Natural, Integer, Rational, Real and Not Irrational $\in \mathbb{Z}, \mathbb{Q}, \mathbb{R}$
Negative whole number, can be expressed as a fraction and is on the number line

π - Not Natural, Not an Integer, Not Rational, Real and Irrational $\in \mathbb{R}, \mathbb{R} \setminus \mathbb{Q}$

It is on the number line and it has an infinite amount of decimal places

4.5

State which set of numbers (Natural numbers, Integers etc...) the following numbers come under -8 , $\frac{1}{3}$, 6, $\sqrt{2}$, $\frac{\pi}{2}$

-8 - Not Natural, Integer, Rational, Real and Not Irrational $\in \mathbb{Z}, \mathbb{Q}, \mathbb{R}$
 Negative whole number, can be expressed as a fraction and is on the number line

$\frac{1}{3}$ - Not Natural, Not an Integer, Rational, Real and Not Irrational $\in \mathbb{Q}, \mathbb{R}$
 Not a whole number, can be expressed as a fraction and is on the number line

6 – Natural, Integer, Rational, Real, Not Irrational $\in \mathbb{N}, \mathbb{Z}, \mathbb{Q}, \mathbb{R}$
 Whole number that's positive and on the number line

$\sqrt{2}$ – Not Natural, Not an Integer, Not Rational, Real and Irrational $\in \mathbb{R}, \mathbb{R} \setminus \mathbb{Q}$
 It is on the number line and it has an infinite amount of decimal places

$\frac{\pi}{2}$ - Not Natural, Not an Integer, Not Rational, Real and Irrational $\in \mathbb{R}, \mathbb{R} \setminus \mathbb{Q}$
 It is on the number line and it has an infinite amount of decimal places