



Level 3 Certificate MATHEMATICAL STUDIES

Paper 1

June 2025

Preliminary Material

To be opened and issued to candidates on
Saturday 1 March 2025 or as soon as possible after that date.

REMINDER TO CANDIDATES

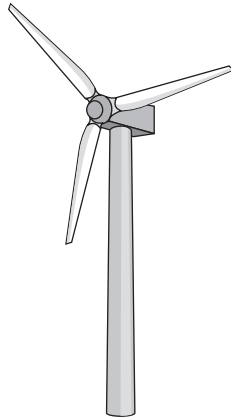
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Wind Turbines

Wind turbines generate a form of renewable energy. They are increasingly being used to produce electricity in many countries including the UK.



The amount of electricity generated by a wind turbine is affected by a number of key factors including wind speed and the size of the blades.

A turbine with blade lengths of 70 metres has a rotor diameter of 140 metres.

Wind speed

Wind speed affects the efficiency of the wind turbine.

If the wind speed is too low, the turbine will not turn.

If the wind speed is too high, the turbine turns too fast to operate properly and also may become damaged. At high wind speeds wind turbines are usually switched off.

Wind speeds for normal operation range between 3 metres per second and 25 metres per second, with the greatest efficiency occurring at speeds towards the middle of this range.

Capacity

Wind turbines commonly produce considerably less power than the rated capacity, which is the maximum amount of power they could produce if they ran all the time.

The capacity factor takes into account times when the turbine is not operating because of weather conditions, maintenance or technical problems. This is expressed as a percentage of the maximum capacity available and is usually between 25% and 40%.

Blade size

The heights of wind turbines have been increasing over the last 20 years. In the late 1990's wind turbines tended to be under 80 metres tall, with a rotor diameter of only 50 metres. Now some of the biggest wind turbines have rotor diameters of over 200 metres. This means they can sweep a larger area and so generate more electricity.

Calculating power output

There are formulae that can be used to work out the power output in watts of a wind turbine.

Electricity usage

The government wants to increase the use of wind turbines in the future to provide the electricity for a large proportion of homes in the UK.

Currently, about 1200 **megawatts** of electricity can power about one million homes.

Income Tax and National Insurance 2024–2025

Income tax 2024–2025

Many people in the UK have a personal allowance. This is their annual amount of tax-free income. The standard personal allowance for 2024–2025 is £12 570

However, if your annual income is more than £100 000 your personal allowance is reduced. Your personal allowance goes down by £1 for every £2 that your income is above £100 000. This means that your personal allowance is zero if your income is £125 140 or over.

The rates of income tax you pay depend on how much income you have **above** your personal allowance.

Income tax rates and taxable bands 2024–2025

Income after allowances	Income tax rate
up to £37 700	20%
over £37 700 and up to £125 140	40%
above £125 140	45%

To calculate your income tax

Find your taxable income by subtracting your personal allowance from your annual gross income.

You pay income tax at 20% on the first £37 700 of your taxable income.

You pay income tax at 40% on your taxable income over £37 700 and up to £125 140

You pay income tax at 45% on your taxable income over £125 140

National Insurance (NI) 2024–2025

Percentage NI due	Minimum monthly income	Maximum monthly income	Minimum yearly income	Maximum yearly income
0%		up to £1048		£12 570
8%	£1048	£4189	£12 570	£50 270
2%	above £4189		above £50 270	

Examples

A person who has a monthly income of £1800 pays 8% on the amount above £1048

A person who has a yearly income of £62 000 pays 8% on the amount between £12 570 and £50 270 plus 2% on the amount above £50 270

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