A4 MACHINE LEARNING · A4.1

Machine learning fundamentals

What machine learning is, the three ways it **learns** (supervised, unsupervised, reinforcement), and the **hardware** it runs on.

01 What is ML?

ML	Learns patterns from data, not coded rules.
Traditional	A human writes the rules.
ML way	The computer learns the rules (a model).
Training	Learning from example data.
Model	The learned rules.
AI	ML is a branch of AI.

02 Supervised tasks

Supervised	Trains on labelled data.
Label	The correct output for each input.
Classification	Predict a category (spam / not spam).
Regression	Predict a number (a price).
Goal	Predict accurately on new data.

03 The three types of machine learning

SL

Supervised

Labelled data (inputs + correct outputs). Learns to predict. Classification and regression.

UL

Unsupervised

Unlabelled data. Finds structure on its own. Clustering and association rules.

RL

Reinforcement

An agent acts in an environment and learns by trial and error to maximise reward.

04 Hardware by stage

Dev/test	CPU and a laptop; small data.
Data eng.	Lots of RAM and fast storage.
Training	GPU/TPU for parallel maths; cloud.
Inference	Lighter: CPU or edge device.

05 Applications

Classify	Spam filters, image recognition.
Regress	Price and demand forecasting.
Cluster	Customer segmentation.
Reinforce	Self-driving cars, game AI.
NLP	Translation, chatbots.

06 Know the difference

Supervised vs unsupervised	Labelled data with known answers versus unlabelled data where the model finds patterns.	DATA
Classification vs regression	Predicting a category versus predicting a continuous number.	OUTPUT
Training vs inference	Teaching the model (heavy, GPU/TPU) versus running it to predict (light, CPU/edge).	STAGE
ML vs traditional	The computer learns the rules from data versus a human writing the rules as code.	APPROACH

FINAL PASS BEFORE THE EXAM

Rapid exam tips

Eight things that lose marks in Paper 1 if you slip on them. Skim before you walk in.

01

ML learns the rules from data; traditional programming is given the rules.

02

Supervised = labelled data; **unsupervised** = unlabelled data.

03

Reinforcement learning uses a **reward**, not a labelled dataset.

04

Classification predicts a category; **regression** predicts a continuous number.

05

Training needs GPU/TPU; **inference** can run on a CPU or edge device.

06

Both classification and regression are **supervised** tasks.

07

Link each **application** to its learning type for full marks.

08

ML is a branch of **AI**; the **model** is the rules the computer learned.