

Round 1

MSc Climate Change and Sustainability

Quantitative Skills (Total Questions 30)

Question 1

The mean annual rainfall of 10 districts is 920 mm with a standard deviation of 60 mm. What will the new mean if we add one more district with 1100 mm rainfall?

- a) 936mm
- b) 940 mm
- c) 945 mm
- d) 950 mm

Question 2

The population of a city increases continuously at a rate proportional to its current size. If the population doubles in 10 years, in how many years will it become four times?

- a) 15 years
- b) 20 years
- c) 25 years
- d) 30 years

Question 3

A random variable X has mean 10 and variance 9. If $Y=3X-5$, what is $E(Y^2)$?

- a) 400
- b) 385
- c) 395
- d) 706

Question 4

If the probability density function of X is $f(x)=kx$ for $0<x<2$, find the value of k .

- a) 0.25
- b) 0.5
- c) 1
- d) 2

Question 5

The correlation coefficient between temperature ($^{\circ}\text{C}$) and ice-cream sales (₹) is 0.9. What is the percentage of variation in sales explained by temperature?

- a) 81%
- b) 90%
- c) 91%
- d) 99%

Question 6

A box contains 5 red, 4 blue, and 3 green balls. Two balls are drawn without replacement. What is the probability that both are of different colors?

- a) $47/66$
- b) $40/70$
- c) $37/66$
- d) $36/70$

Question 7

The time (in minutes) to solve a particular question is normally distributed with mean 40 and standard deviation 8. What proportion of students take between 32 and 48 minutes?

- a) 34%
- b) 68%
- c) 95%
- d) 84%

Question 8

What is the determinant of the following matrix?

$$\begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$$

- a) 10
- b) -2
- c) 2
- d) -5

Question 9

If $\log_{10}2=0.3010$ and $\log_{10}3=0.4771$, then find $\log_{10}12$.

- a) 1.0791
- b) 1.0691
- c) 1.077
- d) 1.078

Question 10

A dataset contains 10 observations with a total sum of values $(\Sigma x) = 200$ and a sum of squared values $(\Sigma x^2) = 4200$. Calculate the standard deviation of the dataset.

- a) 2.3
- b) 4.7
- c) 6.3
- d) 8.0

Question 11

If $P(A)=0.6$, $P(B)=0.5$, and $P(A \cap B)=0.3$, what is $P(A|B)$?

- a) 0.3
- b) 0.5
- c) 0.6
- d) 0.7

Question 12

A dataset follows the equation $y=2x+5$. If the correlation coefficient between x and y is computed, what will it be?

- a) 0

- b) 1
- c) -1
- d) 0.5

Question 13

If a geometric progression has a first term of 5 and fourth term of 135, what is the common ratio?

- a) 2
- b) 3
- c) 4
- d) 5

Question 14

If A and B are independent events with $P(A)=0.4$ and $P(A \cup B)=0.7$, what is $P(B)$?

- a) 0.3
- b) 0.4
- c) 0.5
- d) 0.6

Question 15

The mean monthly temperature of a city for 12 months has a variance of 16°C . What is the standard deviation?

- a) 2°C
- b) 3°C
- c) 4°C
- d) 5°C

Question 16

A cylindrical water tank has diameter 10 m and height 5 m. If water density is 1000 kg/m^3 , what is the mass of water it can hold (in tonnes)?

- a) 392
- b) 393
- c) 394
- d) 395

Question 17

The eigenvalues of the matrix are:

$$\begin{bmatrix} 2 & 0 \\ 0 & 3 \end{bmatrix}$$

- a) 5 and 1
- b) 2 and 3
- c) 3 and -2
- d) 0 and 5

Question 18

A sample has mean 50, standard deviation 10, and $n = 100$. What is the 95% confidence interval for the population mean?

- a) (48, 52)
- b) (49, 51)
- c) (47, 53)
- d) (45, 55)

Question 19

A climate model predicts rainfall as $R=2.5T+30$, where T is temperature in $^{\circ}\text{C}$. If temperature increases by 4°C , what is the percentage increase in rainfall?

- a) 10%
- b) 20%
- c) 25%
- d) Cannot be determined without baseline rainfall.

Question 20

Let X and Y be uncorrelated random variables with variances 9 and 16, respectively. What is the variance of $2X+3Y$?

- a) 61
- b) 75
- c) 90
- d) 180

Question 21

The roots of $2x^2 - 5x + 2 = 0$ are:

- a) 1 and 2
- b) $\frac{1}{2}$ and 2
- c) 1 and $\frac{1}{2}$
- d) 1 and 3

Question 22

If a 3×3 determinant has two identical rows, what is its value?

- a) 0
- b) 1
- c) -1
- d) Cannot be determined

Question 23

If the harmonic mean of two numbers is 12 and their geometric mean is 16, what is their arithmetic mean?

- a) 18.6
- b) 19.5
- c) 20.1
- d) 21.3

Question 24

A sample of 64 values has an average of 25 and a standard deviation of 8. If the population mean is assumed to be 27, what is the Z-score for the sample mean?

- a) 1.0
- b) -2.0

- c) -1.5
- d) 2.0

Question 25

If $f(x)=x^3-3x^2+2x$, find the first derivative of $f(x)$.

- a) $3x^2-6x+2$
- b) $3x^2-6x+1$
- c) $2x^2-6x+2$
- d) x^2-6x+3

Question 26

If the sum of an infinite geometric series is 8 and its first term is 5, what is the common ratio?

- a) 0.512
- b) 0.431
- c) 0.375
- d) 0.222

Question 27

A small watershed loses 20% of its rainfall to evaporation and 30% to infiltration. If the total rainfall is 1200 mm, what is the runoff?

- a) 400 mm
- b) 500 mm
- c) 600 mm
- d) 700 mm

Question 28

In a regression equation $y=a+bx$, if $b=0$, what does it imply?

- a) Perfect correlation
- b) No correlation
- c) Negative correlation
- d) Infinite correlation

Question 29

If a country's CO₂ emissions grow at 6% per year, how long will it take for emissions to double?

- a) 10 years
- b) 11 years
- c) 12 years
- d) 13 years

Question 30

A variable X has the following frequency distribution (f):

X 10 20 30 40 50

f 5 10 20 10 5

What is the mean of X?

- a) 30
- b) 32
- c) 28
- d) 35

Data Literacy (Total Questions 5)

Question 1

A dataset of household energy consumption was collected only from urban households using smart meters. Which of the following statements best describes the main limitation of using this dataset to infer national household energy patterns?

- (a) The dataset may contain random errors in readings.
- (b) The sample lacks representation of rural or non-metered households, introducing selection bias.
- (c) The dataset size is too small for any valid inference.
- (d) Urban energy patterns are identical to rural ones if adjusted for income.

Question 2

A dataset shows average monthly rainfall across 50 districts. When you take the logarithm of rainfall values, what kind of pattern or issue are you most likely addressing?

- (a) Remove outliers from the dataset.
- (b) Reduce skewness in positively skewed data and stabilize variance.
- (c) Convert units from mm to cm.
- (d) Simplify the arithmetic mean calculation.

Question 3

A study finds a strong correlation ($r = 0.92$) between ice cream sales and the number of drowning incidents in a coastal city. What is the most appropriate conclusion?

- (a) Eating ice cream causes drowning.
- (b) Drowning causes more ice cream to be sold.
- (c) Both variables are influenced by a lurking variable — temperature.
- (d) The correlation coefficient is incorrect.

Question 4

A researcher reports that the mean annual temperature is $26.4\text{ }^{\circ}\text{C} \pm 0.8\text{ }^{\circ}\text{C}$ at 95% confidence. Which of the following best interprets this statement?

- (a) There is a 95% chance the true mean is $26.4\text{ }^{\circ}\text{C}$.
- (b) There is a 95% chance the sample mean is between $25.6\text{ }^{\circ}\text{C}$ and $27.2\text{ }^{\circ}\text{C}$.
- (c) We are 95% confident that the true population mean lies between $25.6\text{ }^{\circ}\text{C}$ and $27.2\text{ }^{\circ}\text{C}$.
- (d) 95% of all future samples will have means within $0.8\text{ }^{\circ}\text{C}$ of $26.4\text{ }^{\circ}\text{C}$.

Question 5. You are given access to anonymized health data to study the effects of air pollution. Later, you notice a pattern that could identify a few individuals from small villages. What should you do?

- (a) Continue analysis since the data was officially shared.
- (b) Re-identify the individuals to confirm your findings.
- (c) Inform the data provider about the potential re-identification risk and avoid using that subset.
- (d) Share findings publicly because it's for scientific benefit.

Climate and Sustainability (Total Questions 10)

Question 1

Assertion (A): Aluminium can be infinitely recycled without losing its quality.

Reason (R): Aluminium recycling involves melting the metal, which does not degrade its physical properties.

Options:

- a) Both A and R are true, and R explains A.
- b) Both A and R are true, but R does not explain A.
- c) A is true, but R is false.
- d) A is false, but R is true.

Question 2

Assertion (A): The increase in atmospheric carbon dioxide results in ocean acidification, negatively impacting marine ecosystems.

Reason (R): When carbon dioxide dissolves in seawater, it reacts with water to form sulfuric acid, which lowers the ocean's pH and dissolves marine organisms' shells.

Options:

- a) Both A and R are true, and R explains A.
- b) Both A and R are true, but R does not explain A.
- c) A is true, but R is false.
- d) A is false, but R is true.

Question 3

Assertion (A): Climate sensitivity is primarily influenced by cloud albedo feedback.

Reason (R): Cloud albedo feedback increases the absorption of infrared radiation, trapping more heat in the atmosphere and raising global temperatures.

Options:

- a) Both A and R are true, and R explains A.
- b) Both A and R are true, but R does not explain A.
- c) A is true, but R is false.
- d) A is false, but R is true.

Question 4.

Which of the following correctly matches the climate agreements with their descriptions?

Name	Description
1. Paris Agreement	A. Treaty to phase out substances depleting the ozone layer.

- | | |
|-------------------------|---|
| 2. Kyoto Protocol | B. Agreement from 2009 focusing on climate financing and emissions targets. |
| 3. Montreal Protocol | C. Agreement to limit global warming to below 2°C. |
| 4. Copenhagen Accord | D. First treaty with binding emissions reduction targets. |
| 5. Glasgow Climate Pact | E. Pact from COP26 focusing on climate action commitments. |

- a) 1-B, 2-A, 3-C, 4-D, 5-E
- b) 1-C, 2-D, 3-A, 4-B, 5-E
- c) 1-A, 2-C, 3-D, 4-E, 5-B
- d) 1-E, 2-B, 3-A, 4-C, 5-D

Question 5

Which of the following correctly matches the sustainability-related terms with their descriptions?

- | | |
|---|--|
| 1. Natural Capital | A. Evaluation of environmental impacts before project approval. |
| 2. Social License to Operate (SLO) | B. Approval from communities for ethical practices. |
| 3. Just Transition | C. Capital comprising natural resources and ecosystems. |
| 4. Integrated Water Resources Management (IWRM) | D. Sustainable management of water resources. |
| 5. Sustainable Supply Chain Management | E. Fair transformation for workers during sustainability shifts. |
| 6. Carbon Sequestration | F. Agricultural practices that integrate ecological principles. |
| 7. Environmental Impact Assessment (EIA) | G. Capturing atmospheric carbon to combat climate change. |
| 8. Agroecology | H. Managing supply chains to enhance sustainability. |

- a) 1-C, 2-B, 3-E, 4-D, 5-H, 6-G, 7-A, 8-F
- b) 1-C, 2-A, 3-B, 4-D, 5-F, 6-E, 7-G, 8-H
- c) 1-D, 2-B, 3-F, 4-C, 5-H, 6-G, 7-A, 8-E
- d) 1-F, 2-E, 3-C, 4-B, 5-D, 6-H, 7-G, 8-A

Question 6

Which of the following correctly matches the Sustainable Development Goals (SDGs) with their corresponding goals?

SDG Name	Goal
1. SDG 1	A. Life Below Water
2. SDG 6	B. Affordable and Clean Energy
3. SDG 7	C. Clean Water and Sanitation
4. SDG 11	D. Climate Action
5. SDG 13	E. Sustainable Cities and Communities
6. SDG 14	F. No Poverty
7. SDG 15	G. Life on Land
8. SDG 17	H. Partnerships for the Goals

- a) 1-A, 2-F, 3-C, 4-B, 5-D, 6-G, 7-H, 8-E
- b) 1-D, 2-E, 3-B, 4-F, 5-C, 6-G, 7-A, 8-H
- c) 1-F, 2-C, 3-B, 4-E, 5-D, 6-A, 7-G, 8-H
- d) 1-G, 2-A, 3-D, 4-E, 5-F, 6-H, 7-C, 8-B

Question 7

The radiative forcing of a greenhouse gas is determined by several factors. Which of the following contributes the most to the radiative forcing of CO₂ in the modern era?

- a) The rate at which CO₂ is absorbed by the ocean
- b) The increase in CO₂ concentration due to anthropogenic emissions
- c) The residence time of CO₂ in the atmosphere
- d) The ability of CO₂ to absorb shortwave solar radiation

Question 8

Which of the following best represents the three pillars of sustainability?

- a) Economic growth, technological innovation, and resource extraction.
- B) Environmental conservation, economic growth, and social equity.
- c) Renewable energy, carbon trading, and climate action.
- d) Environmental policies, financial investments, and industrial development.

Question 9

What is the term for the phenomenon where increased concentrations of greenhouse gases lead to a rise in global temperatures, which in turn affects the carbon cycle?

- a) Greenhouse Effect
- b) Climate Resilience
- c) Ocean Acidification
- d) Climate-Carbon Feedback Loop

Question 10

Consider the following statements and choose what happens to sunlight as it passes through Earth's atmosphere? Select the best answer from below.

1. Sunlight is absorbed.
2. Sunlight is reflected back into space.
3. Sunlight is scattered and some reaches the surface.
4. Sunlight is unaffected by the atmosphere.

Select the best answer from below.

- a) 1, 2 and 3
 - b) 1 and 3
 - c) 1 and 2
 - d) All the above
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Round 2

MSc Climate Change and Sustainability

Quantitative Skills: Total Questions: 30

Q1. The average of 5 numbers is 24. If one number is removed, the average becomes 22. What is the removed number?

- a) 28
- b) 30
- c) 32
- d) 34

Q2. If $x + 1/x = 5$, find the value of $x^2 + 1/x^2$.

- a) 21
- b) 23
- c) 25
- d) 27

Q3. A number is first increased by 25% and then decreased by 20%. What is the net percentage change?

- a) No change
- b) -5%
- c) +5%
- d) -10%

Q4. The sum of the first (n) even natural numbers is 132. Find (n).

- a) 10
- b) 11
- c) 12
- d) 13

Q5. If $(2^x = 16)$, then (2^{x+1}) equals:

- a) 16
- b) 24
- c) 32
- d) 64

Q6. A dice is thrown twice. What is the probability that the sum is greater than 9?

- a) $1/6$
- b) $5/36$
- c) $1/4$
- d) $7/36$

Q7. If the mean of 8 observations is 15 and their variance is 4, what is the standard deviation?

- a) 2
- b) 4
- c) 8
- d) 16

Q8. The ratio of boys to girls in a class is 3:2. If there are 15 boys, how many students are there in total?

- a) 20
- b) 24
- c) 25
- d) 30

Q9. If $\log_{10} 4 = 0.6020$, find $\log_{10} 40$.

- a) 1.6020
- b) 0.6020
- c) 2.6020
- d) 1.2040

Q10. If the radius of a sphere is reduced by 10%, by approximately what percentage does its volume reduce?

- a) 10%
- b) 20%

- c) 27%
- d) 30%

Q11. If two events A and B are independent with $(P(A)=0.4)$ and $(P(B)=0.5)$, what is $(P(A|B))$?

- a) 0.2
- b) 0.4
- c) 0.5
- d) 0.9

Q12. The roots of $(x^2 - 7x + 10 = 0)$ are:

- a) 2 and 5
- b) 3 and 7
- c) -2 and -5
- d) 1 and 10

Q13. If the arithmetic mean of two numbers is 10 and their geometric mean is 8, what is the product of the numbers?

- a) 64
- b) 80
- c) 100
- d) 160

Q14. The probability that a student passes mathematics is 0.7 and physics is 0.6. If the probability of passing both is 0.4, what is the probability of passing at least one?

- a) 0.9
- b) 0.8
- c) 0.7
- d) 1.0

Q15. If $f(x) = x^3$, what is the value of first derivative of $f(2)$?

- a) 6
- b) 8

- c) 12
- d) 24

Q16. A data set has values (5, 5, 5, 5, 25). Which statement is true?

- a) Mean = Median
- b) Mean > Median
- c) Mean < Median
- d) Mean = Mode

Q17. If $(x:y = 5:8)$ and $(y:z = 16:9)$, find $(x:z)$.

- a) 5:9
- b) 10:9
- c) 20:9
- d) 40:9

Q18. The determinant of the matrix

$$\begin{vmatrix} 2 & 3 \\ 4 & 6 \end{vmatrix}$$

is:

- a) 0
- b) -6
- c) 12
- d) 6

Q19. If the standard deviation of a data set is zero, all observations are:

- a) Zero
- b) Different
- c) Random
- d) Equal

Q20. A train travels 60 km at speed v and another 60 km at speed $2v$. What is the average speed for the entire journey?

- a) $1.5v$
- b) $4v/3$
- c) v
- d) $2v$

Q21. If the probability of rain on any given day is 0.2, what is the probability that it rains at least once in two days?

- a) 0.36
- b) 0.32
- c) 0.04
- d) 0.40

Q22. If $(x^2 = 16)$, how many real solutions does x have?

- a) 0
- b) 1
- c) 2
- d) 4

Q23. The sum of the interior angles of a polygon is 1260° . How many sides does it have?

- a) 8
- b) 9
- c) 10
- d) 11

Q24. If the mean of 20 observations is 30 and each observation is increased by 5, what is the new mean?

- a) 30
- b) 32.5
- c) 37.5
- d) 35

Q25. Which of the following has the largest value?

- a) $2^{\log_2 16} - 1$
- b) $\log_2(2^5)$
- c) $4^{(3/2)}$

d) $(\frac{1}{2})^{-3} + 1$

Q26. If the probability of success is p , what is the probability of exactly one success in two independent trials?

- a) p^2
- b) $2p(1-p)$
- c) $(1-p)^2$
- d) $p(1-p)$

Q27. If the slope of a line is undefined, the line is:

- a) Parallel to the y-axis
- b) Parallel to the x-axis
- c) Passing through the origin
- d) Having zero slope

Q28. A number when divided by 7 leaves remainder 3. What is the remainder when twice the number is divided by 7?

- a) 1
- b) 3
- c) 6
- d) 0

Q29. If $\frac{1}{x} + \frac{1}{y} = \frac{1}{6}$ and $x=y$, what is x ?

- a) 6
- b) 12
- c) 3
- d) 24

Q30. If the mean and median of a distribution are equal, the distribution is most likely:

- a) Left-skewed
- b) Right-skewed
- c) Symmetric
- d) Bimodal

Data Literacy (Total Questions: 5)

Question 1

A national employment survey is conducted online and reports that 72% of respondents prefer remote work. Which inference is least defensible based on this result?

- (a) Internet access may influence who responds to the survey.
- (b) The result may overestimate preference for remote work among informal workers.
- (c) The sample may underrepresent older or rural populations.
- (d) The result accurately reflects national preferences because it was an online survey.

Question 2

A dashboard reports that average household income increased by 15% over five years. During the same period, median income increased by only 3%. Which interpretation is most consistent with this pattern?

- (a) Income inequality has likely increased.
- (b) All households experienced proportional income growth.
- (c) The data contains measurement errors.
- (d) Inflation has been fully adjusted for.

Question 3

You are comparing two datasets measuring air quality from different sensors. Dataset A has higher variance but the same mean as Dataset B. Which statement is necessarily true?

- (a) Dataset A is less reliable than Dataset B.
- (b) Dataset A contains more extreme pollution events.
- (c) Dataset A has greater dispersion of values around the mean.
- (d) Dataset B must have fewer observations.

Question 4

A predictive model for student performance shows high accuracy on training data but performs poorly on unseen test data. From a data-literacy perspective, what is the most likely explanation?

- (a) The dataset is too small to analyze.
- (b) The model has learned noise rather than general patterns.
- (c) The test data contains incorrect labels.
- (d) The correlation between inputs and outcomes is zero.

Question 5

A government report states: *“Districts with higher literacy rates have lower crime rates.”* No causal analysis is presented. Which conclusion is most methodologically sound?

- (a) Increasing literacy will directly reduce crime.
- (b) Crime reduction policies should focus only on education.
- (c) The relationship may be influenced by confounding factors such as income or urbanization.
- (d) The observed relationship must be spurious.

Climate and Sustainability (10 Questions)

Question 1

Which of the following best explains why methane (CH₄) has a much higher Global Warming Potential (GWP) than CO₂ over a 20-year time horizon?

- a) Methane absorbs more shortwave solar radiation than CO₂
- b) Methane has stronger infrared absorption and a shorter atmospheric lifetime
- c) Methane is present in higher atmospheric concentration than CO₂
- d) Methane directly destroys stratospheric ozone

Question 2

Which process contributes most directly to positive feedback in Arctic climate change?

- a) Increased longwave radiation emitted by snow-covered surfaces
- b) Ice–albedo feedback from melting sea ice
- c) Increased salinity of Arctic waters
- d) Enhanced geothermal heat flux

Question 3

Which statement best distinguishes climate mitigation from climate adaptation?

- a) Mitigation reduces vulnerability; adaptation reduces emissions
- b) Mitigation addresses causes of climate change; adaptation addresses impacts
- c) Mitigation is local; adaptation is global
- d) Mitigation is short-term; adaptation is long-term

Question 4

Which of the following is most important to ensure that carbon offset projects actually reduce emissions?

- a) High prices for carbon credits
- b) Large number of offset projects
- c) Proper monitoring and verification of emission reductions
- d) Trading carbon credits frequently

Question 5

Why is net-zero not the same as zero emissions?

- a) Net-zero allows emissions if renewable energy is used
- b) Net-zero permits residual emissions balanced by removals
- c) Net-zero applies only to developing countries
- d) Zero emissions include land-use change while net-zero does not

Question 6

Which land-use change typically leads to the largest immediate carbon emissions?

- a) Conversion of grasslands to cropland
- b) Selective logging in temperate forests
- c) Draining and converting peatlands
- d) Urban densification

Question 7

Which of the following best explains why water vapour is not considered a primary driver of anthropogenic climate change?

- a) It does not absorb infrared radiation
- b) Its atmospheric concentration is controlled by temperature
- c) Human activities do not directly control its long-term atmospheric concentration
- d) It does not interact with clouds

Question 8

The concept of planetary boundaries primarily aims to:

- a) Identify safe limits for economic growth
- b) Define national emission targets
- c) Quantify thresholds beyond which Earth system stability may be compromised
- d) Rank countries based on environmental performance

Question 9

Which sector is currently the largest source of global anthropogenic methane emissions?

- a) Energy production and transmission
- b) Waste and landfills
- c) Agriculture (especially livestock)
- d) Industrial chemical manufacturing

Question 10

Which of the following indicators would be least appropriate for assessing progress toward climate-resilient development?

- a) Reduction in climate-related disaster losses
 - b) Expansion of early-warning systems
 - c) Increase in per capita energy consumption
 - d) Improved adaptive capacity of vulnerable communities
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Round 3
MSc Climate Change and Sustainability

Quantitative Skills (Total Questions: 30)

Q1. The average of 10 numbers is 18. If two numbers, each equal to 12, are removed, what is the new average?

- a) 18
- b) 20
- c) 22
- d) 24

Q2. If $a + 1/a = 4$, find $a^2 + 1/a^2$.

- a) 12
- b) 14
- c) 16
- d) 18

Q3. A number is first decreased by 20% and then increased by 25%. What is the net percentage change?

- a) +5%
- b) -5%
- c) +10%
- d) No change

Q4. The sum of the first n odd natural numbers is 169. Find n .

- a) 11
- b) 12
- c) 13
- d) 14

Q5. If $3^x = 81$, then $3^{(x-1)}$ equals:

- a) 9
- b) 27
- c) 81
- d) 243

Q6. Two dice are thrown simultaneously. What is the probability that the product of the two numbers is 6?

- a) $\frac{1}{9}$
- b) $\frac{1}{6}$
- c) $\frac{4}{36}$
- d) $\frac{1}{4}$

Q7. The variance of 10 observations is 9. What is the standard deviation?

- a) 9
- b) 3
- c) 81
- d) 1

Q8. The ratio of men to women in an office is 4:5. If there are 36 men, how many total employees are there?

- a) 72
- b) 80
- c) 81
- d) 90

Q9. If $\log_{10} 7 = 0.8451$, find $\log_{10} 700$.

- a) 1.8451
- b) 2.8451
- c) 3.8451
- d) 0.8451

Q10. If the length and breadth of a rectangle are each increased by 10%, by what percentage does its area increase?

- a) 10%
- b) 20%
- c) 21%
- d) 25%

Q11. Two events A and B are mutually exclusive. $P(A) = 0.3$, $P(B) = 0.4$. Find $P(A \cup B)$.

- a) 0.12
- b) 0.5
- c) 0.7
- d) 1.0

Q12. The roots of $x^2 - 5x + 6 = 0$ are:

- a) 2 and 3
- b) 1 and 6
- c) -2 and -3
- d) 3 and 4

Q13. The arithmetic mean of two numbers is 15 and their geometric mean is 12. Find the product of the two numbers.

- a) 144
- b) 180
- c) 225
- d) 30

Q14. The probability that a student passes English is 0.8 and History is 0.6. If the probability of passing both is 0.5, what is the probability of passing at least one subject?

- a) 0.7
- b) 0.8
- c) 0.9

d) 1.0

Q15. If $f(x) = 2x^2$, what is $f(3)$?

- a) 6
- b) 9
- c) 12
- d) 18

Q16. A data set has values $\{2, 2, 2, 2, 18\}$. Which is true?

- a) Mean = Mode
- b) Mean < Median
- c) Mean > Median
- d) Median = Mode

Q17. If $a:b = 3:7$ and $b:c = 14:9$, find $a:c$.

- a) 3:9
- b) 6:9
- c) 2:3
- d) 1:3

Q18. The determinant of the matrix $[3, 4; 6, 8]$ is:

- a) 24
- b) 0
- c) -6
- d) 12

Q19. If the range of a data set is 0, all observations are:

- a) Zero
- b) Different

- c) Equal
- d) Random

Q20. A car travels 100 km at 50 km/h and 100 km at 100 km/h. What is the average speed for the entire journey?

- a) 75 km/h
- b) 66.7 km/h
- c) 80 km/h
- d) 100 km/h

Q21. If the probability of a machine failing on any day is 0.1, what is the probability that it does not fail on either of two consecutive days?

- a) 0.81
- b) 0.90
- c) 0.19
- d) 0.01

Q22. If $x^2 = 25$, how many real solutions does x have?

- a) 0
- b) 1
- c) 2
- d) 5

Q23. The sum of interior angles of a hexagon is:

- a) 540°
- b) 720°
- c) 900°
- d) 1080°

Q24. If the median of 15 observations is 40 and each observation is decreased by 10, what is the new median?

- a) 30

- b) 40
- c) 50
- d) 25

Q25. Which of the following has the smallest value?

- a) 2^3
- b) $\log_2 32$
- c) $4^{(1/2)}$
- d) $(1/3)^{(-2)}$

Q26. In a binomial experiment with $n = 5$ and $p = 0.5$, what is the probability of exactly 2 successes?

- a) 0.3125
- b) 0.25
- c) 0.1875
- d) 0.5

Q27. If the y-intercept of a line is 0 and its slope is 3, which point lies on the line?

- a) (1, 3)
- b) (2, 9)
- c) (0, 3)
- d) (3, 0)

Q28. A number when divided by 9 leaves remainder 5. What is the remainder when three times the number is divided by 9?

- a) 6
- b) 5
- c) 3
- d) 15

Q29. If $1/p + 1/q = 1/4$ and $p = q$, what is p ?

- a) 4
- b) 6
- c) 8
- d) 12

Q30. A distribution has its mode less than the median, which is less than the mean. The distribution is most likely:

- a) Symmetric
- b) Left-skewed
- c) Right-skewed
- d) Bimodal

Data Literacy (Total Questions: 5)

Question 1

A health survey conducted at urban fitness centres reports that 85% of respondents exercise at least three times per week. Which conclusion is most critically flawed?

- (a) The sample may overrepresent health-conscious individuals.
- (b) The result likely does not reflect the general urban population's exercise habits.
- (c) Rural populations may have different exercise patterns.
- (d) The survey accurately captures national exercise behaviour because a large number of respondents participated.

Question 2

A climate report states that the mean annual temperature in a city rose by 2.4°C over 40 years, while the median rose by only 0.6°C. Which interpretation best explains this pattern?

- (a) A small number of exceptionally hot years are pulling the mean upward.
- (b) All years experienced uniform warming across the city.
- (c) The measurement instruments were miscalibrated in later years.
- (d) Median is always a more accurate measure of temperature change.

Question 3

Two datasets both record daily rainfall (mm) over a year. Dataset X has a standard deviation of 12 mm; Dataset Y has a standard deviation of 3 mm. Both have the same mean. Which statement is necessarily true?

- (a) Dataset X records higher average rainfall than Y.
- (b) Dataset X has greater variability in daily rainfall amounts.
- (c) Dataset Y is more likely to contain data errors.
- (d) Dataset Y was recorded in a drier region.

Question 4

A machine-learning model trained to classify satellite images of deforested areas achieves 98% accuracy on training data but only 61% on new satellite images from a different region. What is the most likely explanation?

- (a) The model requires more computing power to generalise.
- (b) The new region has more forest cover.
- (c) The model has overfit to patterns specific to the training region.
- (d) The training labels were incorrectly assigned.

Question 5

A research paper reports: "Cities with more green spaces have lower rates of heat-related illness." No randomised experiment was conducted. Which conclusion is most methodologically sound?

- (a) Planting more trees will directly reduce heat-related illness in all cities.
- (b) Heat-related illness policies should prioritise vegetation exclusively.
- (c) The association may be confounded by factors such as income, infrastructure quality, or population density.
- (d) The relationship is spurious because observational data cannot show any association.

Question 1

Which of the following best explains why CO₂ remains a more important long-term driver of climate change than methane, despite methane's higher 20-year GWP?

- a) CO₂ is present in higher concentrations in the atmosphere
- b) CO₂ has a much longer atmospheric lifetime, sustaining its warming effect for centuries
- c) CO₂ interacts with stratospheric ozone more strongly
- d) CO₂ absorbs more shortwave radiation than methane

Question 2

Which of the following best describes the mechanism behind thermohaline circulation, and how it is threatened by climate change?

- a) It is driven by wind patterns; threatened by rising sea levels
- b) It is driven by differences in water temperature and salinity; threatened by freshwater influx from melting ice
- c) It is driven by ocean floor topography; threatened by ocean acidification
- d) It is driven by tidal forces; threatened by changes in Earth's rotation

Question 3

Which statement most accurately distinguishes between climate sensitivity and tipping points?

- a) Climate sensitivity measures speed of warming; tipping points measure total warming
- b) Climate sensitivity quantifies equilibrium temperature response to doubled CO₂; tipping points are thresholds triggering self-reinforcing system changes
- c) Climate sensitivity applies only to oceans; tipping points apply only to ice sheets
- d) They are interchangeable terms used in IPCC reports

Question 4

What is the primary reason that REDD+ programmes have sometimes failed to achieve lasting emission reductions?

- a) Forested areas are too remote to monitor
- b) Deforestation often shifts to unprotected areas rather than stopping (leakage)
- c) Carbon prices are too high for developing countries to participate
- d) Forests are not recognised as carbon sinks under international agreements

Question 5

Why does achieving net-zero by 2050 not guarantee limiting warming to 1.5°C above pre-industrial levels?

- a) Net-zero commitments only apply to energy sector emissions
- b) Warming depends on cumulative CO₂ already emitted; the remaining carbon budget may already be exceeded
- c) The 1.5°C target applies only to ocean temperatures
- d) Net-zero is a voluntary target and has no physical climate implications

Question 6

Which of the following soil ecosystems stores the largest amount of carbon per unit area and is most vulnerable to drainage?

- a) Temperate deciduous forest soils
- b) Tropical savannahs
- c) Peatlands
- d) Arid desert soils

Question 7

Which of the following correctly explains the role of aerosols in climate forcing?

- a) Aerosols exclusively cause warming by trapping longwave radiation
- b) Aerosols can cause both cooling (by scattering solar radiation) and warming (by absorbing it), depending on their type
- c) Aerosols have no net effect on radiative forcing
- d) Aerosols are only relevant to stratospheric chemistry, not surface temperature

Question 8

The concept of a 'just transition' in sustainability primarily refers to:

- a) Rapid decarbonisation regardless of social and economic impacts
- b) Ensuring the shift to a low-carbon economy is equitable, protecting workers and communities dependent on fossil fuels
- c) Legal frameworks requiring equal carbon taxes across all nations

- d) Transferring carbon credits from developed to developing nations

Question 9

Which of the following best explains why ocean acidification poses a particular threat to coral reef ecosystems?

- a) Acidic oceans reduce water temperature, which bleaches corals
- b) Lower pH reduces carbonate ion concentrations, impairing corals' ability to build calcium carbonate skeletons
- c) Ocean acidification reduces sunlight penetration needed by coral symbiotic algae
- d) Increased acidity promotes growth of invasive species that consume coral polyps

Question 10

Which of the following would be the most appropriate indicator to include in a national Sustainable Development Goal (SDG) monitoring framework?

- a) Annual GDP growth rate
- b) Percentage of population with access to clean drinking water
- c) Total volume of international trade
- d) Number of new patents filed per year