



UCAT Preparation Course

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Section 3

Quantitative Reasoning

Introduction:

The Quantitative Reasoning (QR) section is the third of four cognitive subtests in UCAT, following Decision Making. This section evaluates your ability to solve numerical problems and interpret data presented in various formats. Unlike traditional mathematics exams, this subtest assesses your capacity to apply basic mathematical concepts to real-world scenarios commonly encountered in medical and dental contexts, all under significant time constraints.

The core task is to work with numerical information presented in tables, charts, graphs, and written passages, performing calculations and drawing conclusions from that data. This subtest does not require advanced mathematical knowledge beyond GCSE/Standard Grade level; rather, it tests your ability to quickly identify relevant information, perform accurate calculations, and select the correct answer from multiple options. The skill being assessed is not abstract mathematical ability but practical numerical reasoning—the capacity to work comfortably with data, proportions, and quantitative relationships in time-pressured situations.

Format and Timing

The Quantitative Reasoning section is a timed, multiple-choice assessment with the following structure, based on the official UCAT specifications:

Feature	Detail
Total Time for Section	26 minutes
Instruction Screen Time	2 minutes (timed separately)
Number of Questions	36 questions
Question Formats	Mostly 4 questions in a row per data set. There can be some data sets with only one question each.
Scoring	Each question is worth 1 mark. The final scaled score ranges from 300 to 900.

The time pressure in this section is intense, with candidates having an average of approximately 42 seconds per question. However, calculation complexity varies significantly—some questions may require multi-step calculations taking over a minute, while others can be answered in 20 seconds. Effective time management and strategic use of the on-screen calculator are, therefore, critical for success.

Numerical Abilities Covered by the Questions

A - Percentages

Basic percentages	Percentage change	Reverse percentage	equivalence to decimals	equivalence to fractions
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1) Basic percentages

Use this when you want part of a number.

- 10% of 80 = 8
- 25% of 60 = 15
- 7% of 200 = 14

A quick method is:

- 10% = divide by 10.
- 5% = half of 10%.
- 1% = divide by 100.

Example:

- 15% of 40 = 10% of 40 + 5% of 40 = 4 + 2 = 6.

2) Percentage change

Use this when something increases or decreases.

Formula:

- Percentage change = $(\text{change} \div \text{original}) \times 100$

Examples:

- Price rises from 50 to 60.

Change = 10.

Percentage increase = $10 \div 50 \times 100 = 20\%$

- A number falls from 80 to 68.

Change = 12.

$$\text{Percentage decrease} = 12 \div 80 \times 100 = 15 \%$$

3) Reverse percentages

Use this when you know the final value and need the original.

Examples:

- A shirt costs £72 after a 20% discount.

Final price is 80% of the original.

$$\text{Original price} = 72 \div 0.8 = 90.$$

So the original price was £90.

- A value becomes 126 after a 5% increase.

Final value is 105% of the original.

$$\text{Original} = 126 \div 1.05 = 120.$$

So the original value was 120.

4) Percentages as decimals

Convert by dividing by 100. Move the decimal point two places to the left.

Examples:

- $25\% = 0.25$
- $7.5\% = 0.075$
- $120\% = 1.2$

Example use:

- $25\% \text{ of } 64 = 0.25 \times 64 = 16.$

5) Percentages as fractions

Convert the percentage to a fraction out of 100, then simplify.

Examples:

- $50\% = 50/100 = 1/2$
- $25\% = 25/100 = 1/4$
- $75\% = 75/100 = 3/4$
- $12.5\% = 12.5/100 = 1/8$
- $75\% \text{ of } 40 = 3/4 \times 40 = 30.$

B - Proportions & Ratios

direct proportion	inverse proportion
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1) direct proportion

In direct proportion, when one quantity goes up, the other goes up by the same factor. The ratio stays constant.

Formula:

- $y \propto x$ "y is directly proportional to x"
- $y = kx$

Examples:

- If 3 pens cost £6, then 6 pens cost £12.
- If 4 kg of apples cost £10, then 1 kg costs £2.50.
- If a car travels 60 km in 1 hour, it travels 120 km in 2 hours.

UCAT-style example:

- 5 notebooks cost £15. How much do 8 notebooks cost?
- Cost per notebook = £3, so 8 notebooks cost £24.

2) inverse proportion

In inverse proportion, when one quantity goes up, the other goes down. The product stays constant.

Formula:

- $y \propto 1/x$ "y is inversely proportional to x"
- $y = k/x$

Examples:

- More workers means fewer days to finish a job.
- More speed means less time for the same distance.
- More pipes filling a tank means less time to fill it.

UCAT-style example:

- 6 workers can finish a job in 12 days.
- How long would 3 workers take?
- Since halving the workers doubles the time, the answer is 24 days.

C - Rates

rates of flow	speed, distance, time
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1) rates of flow

Flow rate means how much passes a point in a given time.

Examples:

- A tap fills 12 litres in 3 minutes.
- Flow rate = $12 \div 3 = 4$ litres per minute.
- A pipe pours 30 litres in 10 minutes.
- Flow rate = $30 \div 10 = 3$ litres per minute.

UCAT-style example:

- A tank is filled at 8 litres per minute for 7 minutes.
- Total water = $8 \times 7 = 56$ litres.

2) rates of speed, distance, and time

Use:

- Speed = Distance $\div$ Time
- Distance = Speed $\times$ Time
- Time = Distance $\div$ Speed

Examples:

- A car travels 120 km in 3 hours. Speed = $120 \div 3 = 40$ km/h.
- A cyclist rides at 15 km/h for 4 hours. Distance = $15 \times 4 = 60$ km.
- A runner covers 18 km at 6 km/h. Time = $18 \div 6 = 3$ hours.

D - Averages

1) Mean

The mean is the total of the values divided by how many values there are.

Example:

- Data: 4, 6, 8, 2, 10
- Mean = $(4+6+8+2+10) \div 5 = 30 \div 5 = 6$

UCAT-style example:

- A student scores 12, 15, 9, and 14 in four quizzes. What's her mean score?
- Mean score = $(12+15+9+14) \div 4 = 50 \div 4 = 12.5$

2) Median

The median is the middle value when the numbers are put in order.

Example with an odd number of values:

- Data: 3, 7, 8, 10, 12
- Ordered already.
- Median = 8

Example with an even number of values:

- Data: 2, 5, 7, 11
- The middle two values are 5 and 7.
- Median = $(5+7) \div 2 = 6$

3) Mode

The mode is the value that appears most often.

Example:

- Data: 1, 2, 2, 3, 4, 4, 4, 5
- Mode = 4

- Data: 7, 8, 8, 9, 10, 10, 10, 12
- Mode = 10

Note:

- A set can have more than one mode.
- If no number repeats, there is no mode.

4) Range

The range is the highest value minus the lowest value in a given set of data.

Examples:

- Data: 5, 9, 12, 15, 20
- Range = $20 - 5 = 15$

- Data: 3, 4, 7, 11, 14
- Range = $14 - 3 = 11$

Why Quantitative Reasoning is Tested

The abilities assessed in this section are deemed essential for future doctors and dentists. Strong quantitative reasoning skills are crucial for:

Clinical Practice:

- Calculating medication dosages based on patient weight, age, and renal function
- Interpreting laboratory results and reference ranges
- Understanding risk calculations and statistical findings in medical literature
- Calculating fluid balances and nutritional requirements
- Interpreting ECG, blood pressure, and other vital sign measurements

Treatment Planning:

- Calculating radiation doses for cancer treatment
- Determining appropriate insulin doses based on blood glucose readings
- Calculating anaesthetic requirements
- Assessing growth percentiles in paediatrics
- Evaluating risk-benefit ratios for different treatment options

Resource Management:

- Managing budgets for clinical departments
- Staff allocation based on patient demand
- Understanding healthcare costs and cost-effectiveness
- Interpreting epidemiological data and population health statistics
- Managing waiting lists and appointment scheduling

Evidence-Based Practice:

- Interpreting clinical trial results
- Understanding statistical significance and confidence intervals
- Evaluating screening programmes and diagnostic test performance
- Calculating positive and negative predictive values
- Understanding incidence, prevalence, and mortality rates

The section tests your ability to work comfortably with numerical information, make accurate calculations under pressure, and apply mathematical reasoning to practical problems—all of which are core competencies in clinical practice where numerical errors can have significant consequences.

Instructions:

1. Time pressure

The Quantitative Reasoning section is 26 minutes long and consists of 36 questions, averaging about 42 seconds per question. However, question complexity varies significantly. When first practising, don't worry about timing—focus on understanding question types and building calculation accuracy. Then progress to timed practice using UCAT official materials. **How to deal with this?**

A. Know when to use the calculator versus mental arithmetic

The on-screen calculator is available but using it for every calculation will slow you down significantly. Develop the judgment to know when mental arithmetic or estimation is sufficient. For simple calculations, mental maths is almost always faster. Reserve the calculator for multi-step calculations or complex division.

B. Develop efficient calculation strategies

Learn and practice mental maths techniques such as:

- Breaking numbers into manageable parts (e.g., $47 \times 6 = (40 \times 6) + (7 \times 6)$)
- Using percentage shortcuts (e.g., 10% of any number is easy, so 20% is double that)
- Using approximation to eliminate clearly wrong answer options

C. Identify question difficulty quickly

Some questions require multiple calculations and data extraction from complex tables. Others can be answered from a single data point. Recognise which is which and allocate time accordingly. If a question appears highly complex, consider making an educated guess and returning to it later.

D. Read the question before analysing the data

For interpreting information questions, read what you're being asked before examining the graph or table. This tells you which parts of the data are relevant and prevents wasted time on unnecessary information processing.

E. Use the whiteboard effectively

Jot down intermediate calculations, notes, or data extractions on your whiteboard. This prevents having to re-read data multiple times and reduces calculation errors. A few seconds of organisation can save significant time on complex questions.

F. Use strategic guessing

When time is running low, eliminate obviously wrong answers and guess from the remaining options. The UCAT does not penalise incorrect answers, so always answer every question. A guess has a 25% chance of being correct; leaving it blank has 0%.

2. Key Strategies for Specific Scenarios

A. Working with tables:

- Always check column headings and row labels—units are often hidden there
- Scan for totals or averages that may already be calculated
- Be careful with data presented in thousands or millions
- Note any footnotes or explanatory text below the table
- Calculate the range of values to understand what would be a reasonable answer

B. Working with graphs:

- Read the title—it tells you what the graph represents
- Check axes scales and labels—a common trick is non-linear or non-zero axes
- For bar charts, compare heights carefully, especially if bars are close in value
- For pie charts, check whether you need percentages or actual values
- For line graphs, be careful with interpolation and extrapolation

C. Working with percentages:

- Always identify whether you need the percentage of a value or the percentage change
- For multiple percentage changes, apply them sequentially, not cumulatively
- Remember: 50% increase followed by 50% decrease does NOT return to the original

value

- For percentage points, this is a simple addition/subtraction (e.g., 40% to 45% is a 5 percentage point increase but a 12.5% relative increase)
- Practice converting between percentages, fractions, and decimals rapidly

D. Working with rates:

- Identify the units clearly (e.g., patients per nurse, incidents per 100,000 population)
- Scale rates appropriately when comparing different population sizes
- Be careful with time units (per hour vs per day vs per week)
- Calculate from first principles rather than relying on memory of formulae

3. Psychological Anchor

A. Keeping calm

Quantitative Reasoning can feel particularly stressful due to time pressure and the need for accuracy. Remember that all candidates find this section challenging. Your goal is not to answer every question correctly but to score higher than the average candidate. Stay calm, work systematically, and trust your preparation.

B. Don't let one difficult set derail you

Sets of questions vary in difficulty. If you encounter a set that seems impossible, remember that subsequent sets may be much more straightforward. Avoid:

- Panicking after a difficult start to a set
- Spending disproportionate time on early questions within a set
- Allowing difficulty to affect your confidence on subsequent questions
- Being reluctant to move on from a question you've invested time in

C. Trust your first instinct

The pressure of UCAT can make you second-guess your arithmetic. However:

- First calculations are often correct if you've been systematic

- Each minute you spend rechecking is a minute you could spend on other questions
- If you've used a logical method, trust the result
- Use flagging for uncertain questions rather than immediate rechecking
- Reserve verification for flagged questions if time permits

D. Accept estimation and approximation

In many cases, the answer options are sufficiently spread that you can estimate rather than calculate precisely. If answer options are A: 82, B: 84, C: 86, D: 88, E: 90, you need precision. If options are A: 60, B: 80, C: 100, D: 120, E: 140, estimation may suffice. Learn to recognise when approximation is acceptable.

4. Essential Formulas

Type	Formula
Percentage of an amount	$\text{Amount} \times (\text{Percentage} \div 100)$
Percentage change	$((\text{New} - \text{Original}) \div \text{Original}) \times 100\%$
Increase by percentage	$\text{Original} \times (1 + \text{Percentage}/100)$
Decrease by percentage	$\text{Original} \times (1 - \text{Percentage}/100)$
Reverse percentage increase	$\text{New} \div (1 + \text{Percentage}/100)$
Reverse percentage decrease	$\text{New} \div (1 - \text{Percentage}/100)$
Average (mean)	$\text{Sum of values} \div \text{Number of values}$
Speed	$\text{Distance} \div \text{Time}$
Density	$\text{Mass} \div \text{Volume}$
Ratio of a:b	a/b

Profit	$\text{Selling Price} - \text{Cost Price}$
Percentage profit	$(\text{Profit} \div \text{Cost Price}) \times 100\%$

Sample Test [Different data sets / Only 16 questions]

Table Questions (4 questions)

Data: Monthly ED attendance and average wait times by triage category (2024)

Month	Red (Critical)	Orange (Urgent)	Yellow (Semi-urgent)	Green (Non-urgent)
Attendance	124	568	892	1,456
Avg Wait (mins)	8	25	47	102

Question 1: In the month shown, what percentage of total ED attendance was classified as Green (Non-urgent)?

- A) 38.5% B) 40.5% C) 43% D) 45.5% E) 48%

Question 2: The hospital wants to reduce Orange category wait times by 20%. What would the new average wait time be?

- A) 15 minutes B) 18 minutes C) 20 minutes D) 22 minutes E) 25 minutes

Question 3: The Red and Orange categories combined represent critical/urgent cases. What is the ratio of critical/urgent to semi-urgent cases?

- A) 7:10 B) 11:18 C) 14:18 D) 16:18 E) 18:22

Question 4: What is the difference in total wait time minutes between Yellow and Green categories (attendance × wait time)?

- A) 95,000 B) 98,000 C) 100,600 D) 102,400 E) 106,500

Table Questions Answer Key with Explanation

Q1 Answer: E

Total attendance = $124 + 568 + 892 + 1,456 = 3,040$

Green category = 1,456

Percentage = $(1,456 \div 3,040) \times 100 = 47.89\% \approx 48\%$

Q2 Answer: C

Current Orange wait = 25 minutes

20% reduction = $25 \times 0.20 = 5$ minutes

New wait time = $25 - 5 = 20$ minutes

Q3 Answer: C

Critical/Urgent = $124 + 568 = 692$

Semi-urgent = 892

The Greatest Common Divisor (GCD) or Greatest Common Factor (GCF) of 692 and 892 is 4
Ratio = $692:892 = 173:223$ (each divided by 4). Still, too complicated. Let's quickly calculate the decimal ratio in this case

Decimal ratio = $692/892 = 0.776$

Decimal ratio of each answer

A) $7:10 \Rightarrow 7/10 = 0.7$

B) $11:18 \Rightarrow 11/18 = 0.611$

C) $14:18 \Rightarrow 14/18 = 0.778$

D) $16:18 \Rightarrow 16/18 = 0.889$

E) $18:22 \Rightarrow 18/22 = 0.818$

Q4 Answer: E

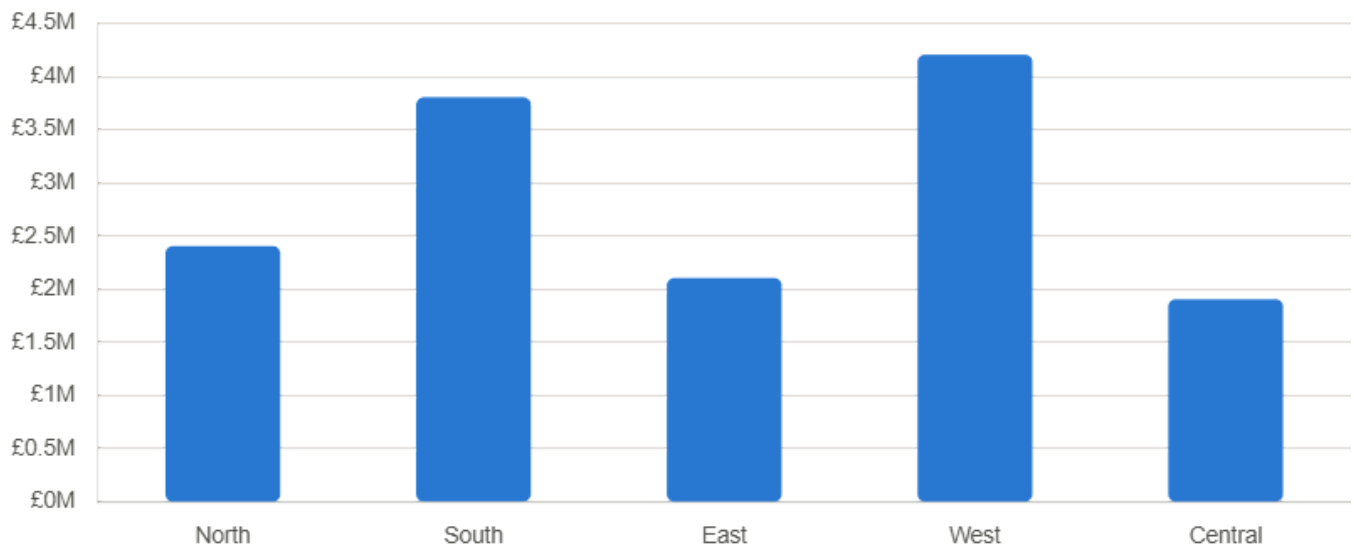
Yellow: $892 \times 47 = 41,924$ minutes

Green: $1,456 \times 102 = 148,512$ minutes

Difference = $148,512 - 41,924 = 106,588$ minutes

Bar Chart Questions (4 questions)

The bar chart demonstrates the sales by region (Q3 2024) of a pharmaceutical company.



- North Region: £2.4M
- South Region: £3.8M
- East Region: £2.1M
- West Region: £4.2M
- Central Region: £1.9M

Question 1: Which region generated approximately a quarter of total pharmaceutical sales?

A) North Region B) South Region C) East Region D) West Region E) Central Region

Question 2: What is the ratio of West Region sales to East Region sales?

A) 1:2 B) 2:1 C) 3:2 D) 4:2 E) 5:2

Question 3: The company projects a 15% increase in sales across all regions for Q4. Which region's projected sales would exceed £4.5M?

A) North Region B) South Region C) East Region D) West Region E) Both South & West Regions

Question 4: If the company allocates budget proportionally to sales performance, and the total budget is £500,000, approximately how much would the East Region receive?

A) £72,900 B) £74,500 C) £77,300 D) £79,000 E) £81,200

Bar Chart Questions Answer Key with Explanation

Q1 Answer: B

- Total sales = £2.4M + £3.8M + £2.1M + £4.2M + £1.9M = £14.4M
- 25% of £14.4M = £3.6M
- South Region at £3.8M is closest to 25% (actually 26.4%)

Q2 Answer: B

West: £4.2M, East: £2.1M

Ratio = 4.2:2.1 = 2:1

Q3 Answer: D

Check the biggest => West current = £4.2M

- 15% increase = £4.2M × 0.15 = £0.63M
- £4.2M + £0.63M = £4.83M => exceeds £4.5M (exceeds £4.5M)
- or
- Projection for Q4 = £4.2M × 1.15 = £4.83M (exceeds £4.5M)

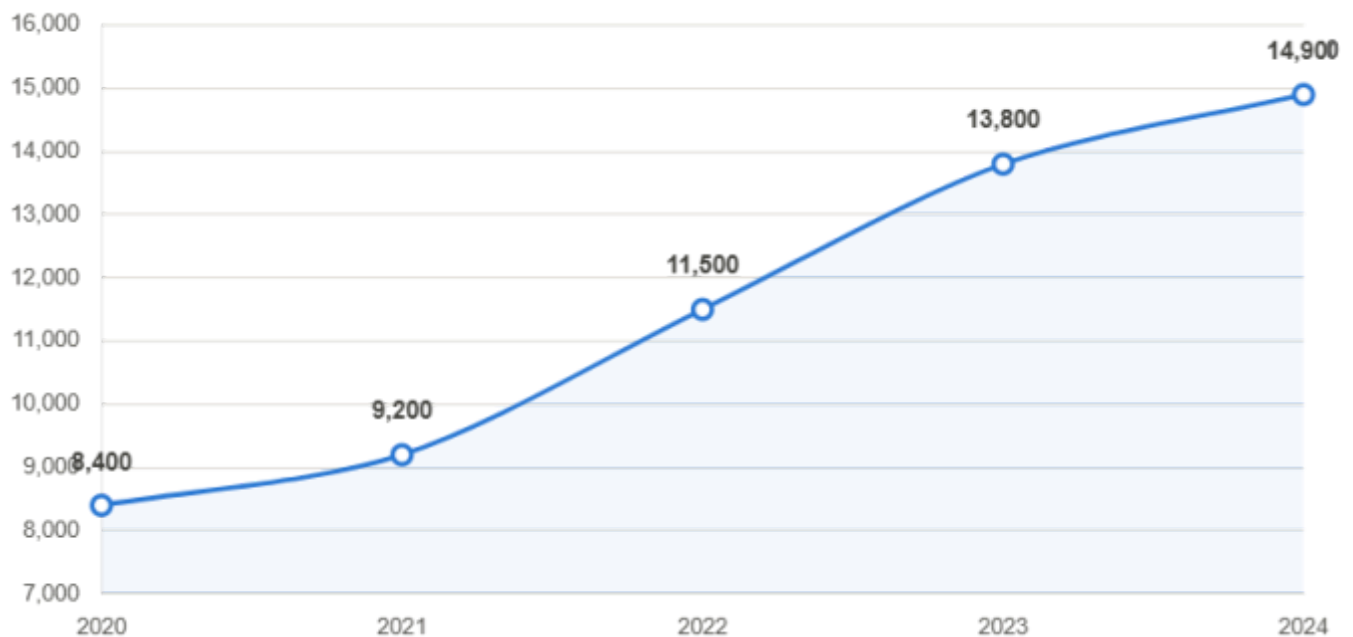
Using same method, check second biggest => South: £4.37M => doesn't exceed
Only West exceeds £4.5M

Q4 Answer: A

- East represents £2.1M of £14.4M total
- Proportion = $2.1 \div 14.4 = 0.1458$ (14.58%)
- Budget allocation = £500,000 × 0.1458 = £72,900

Line Graph Questions (4 questions)

This line graph shows a certain university's application trends (2020-2024)



Question 1: What was the percentage increase in applications from 2020 to 2024?

- A) 42.9% B) 54.8% C) 67.4% D) 77.4% E) 82.2%

Question 2: Which year-on-year period showed the largest absolute percentage increase in applications?

- A) 2020 to 2021 B) 2021 to 2022 C) 2022 to 2023 D) 2023 to 2024 E) Both B&C equally

Question 3: If the trend continues at the 2023-2024 rate of increase, what would applications be in 2025?

- A) 15,540 B) 15,930 C) 16,022 D) 16,087 E) 16,152

Question 4: What is the average annual increase in the number of applications across the entire 4-year period?

- A) 1,375 applications B) 1,625 applications C) 1,750 applications D) 2,000 applications E) 2,200 applications

Line Graph Questions Answer Key with Explanation

Q1 Answer: D

- Increase = $14,900 - 8,400 = 6,500$
- Percentage = $(6,500 \div 8,400) \times 100 = 77.38\% \approx 77.4\%$

Q2 Answer: B

$$\text{Increase Percentage} = \frac{(\text{New Value} - \text{Original Value})}{\text{Original Value}} \times 100$$

- 2020-2021: $8,400$ to $9,200 = +800$

$$\text{Increase Percentage} = \frac{(800)}{8,400} \times 100 = 9.52\%$$

- 2021-2022: $9,200$ to $11,500 = +2,300$

$$\text{Increase Percentage} = \frac{(2300)}{9,200} \times 100 = 25\%$$

- 2022-2023: $11,500$ to $13,800 = +2,300$ (equal to the previous)

$$\text{Increase Percentage} = \frac{(2300)}{11,500} \times 100 = 20\%$$

- 2023-2024: $13,800$ to $14,900 = +1,100$

$$\text{Increase Percentage} = \frac{(1,100)}{13,800} \times 100 = 7.97\%$$

Q3 Answer: D

From the previous question, we know that the increase percentage from 2023 to 2024 is 7.97%.

- Applications in 2024 = $14,900$
- New applications in 2025 = $14,900 \times 7.97\% = 14,900 \times 0.0797 = 1,187.53 \approx 1,187$
- Total applications in 2025 = $14,900 + 1,187 = 16,087$

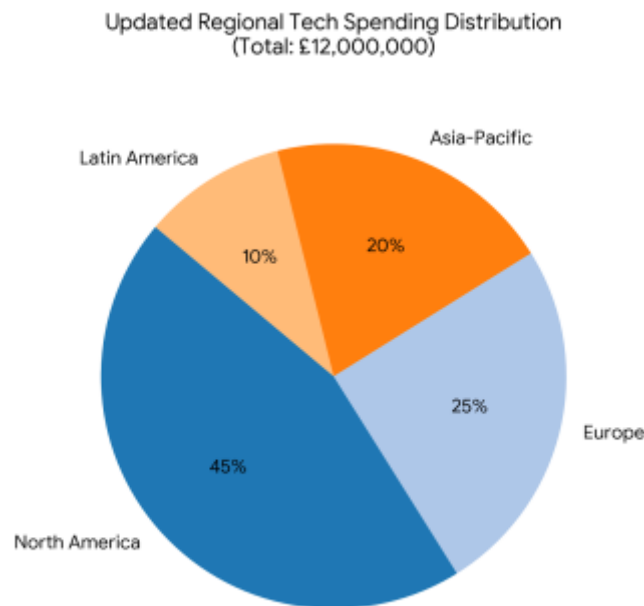
Using same method, check second biggest => South: £4.37M => doesn't exceed
Only West exceeds £4.5M

Q4 Answer: B

- Total increase over the 4 yearperiod = $14,900 - 8,400 = 6,500$
- Average per year = $6,500 \div 4 = 1,625$

Pie Chart Questions (4 questions)

A global technology firm allocated a total annual budget of £12,000,000 across four regional divisions.



Question 1: The budget allocated to the Asia-Pacific division is directly proportional to the number of regional software engineers employed, which currently stands at 80. If the firm plans to expand the Asia-Pacific engineering team to 105 engineers while maintaining the exact same funding ratio per engineer, what will the new required budget for Asia-Pacific be?

- A) £2,500,000 B) £2,850,000 C) £3,150,000 D) £3,360,000 E) £3,600,000

Question 2: A specialised IT infrastructure project funded by the Latin America budget takes 6 systems architects working together a total of 20 days to complete. Assuming all architects work at the same constant rate, how many days would it take to complete the exact same task if 2 additional architects are added to the team?

- A) 8 B) 10 C) 12 D) 15 E) 16

Question 3: What is the median budget allocation across these four regional divisions?

- A) £2,400,000 B) £2,700,000 C) £3,000,000 D) £4,200,000 E) 2,850,000

Question 4: What is the range between the highest regional budget allocation and the lowest regional budget allocation?

- A) £2,700,000 B) £3,000,000 C) £3,400,000 D) £3,700,000 E) £4,200,000

Pie Chart Questions Answer Key with Explanation

Q1 Answer: C

- The budget allocated to the Asia-Pacific division = 20% of the total = £12,000,000 X 0.2 = £2,400,000
- Direct proportion means funding per engineer remains constant:
- $\text{Funding per Engineer} = \frac{£2,400,000}{80} = £30,000$
- $\text{Budget for 105 engineers} = 105 \times £30,000 = £3,150,000$

Q2 Answer: D

$\text{Total Workload} = \text{Number of Architects} \times \text{Number of Days}$

$\text{Total Workload} = 6 \text{ architects} \times 20 \text{ Days} = 120 \text{ person days}$

Again: $\text{Total Workload} = \text{Number of Architects} \times \text{Number of Days}$

Which means: $\text{Number of Days} = \frac{\text{Total Workload}}{\text{Number of Architects}} = \frac{120}{8} = 15 \text{ days}$

Q3 Answer: B

The median for an even-numbered set of data is the mean of the two middle values after all the values have been sorted in ascending order:

$$\text{Median} = \frac{£3,000,000 + 2,400,000}{2} = £2,700,000$$

Q4 Answer: E

- Range is the difference between the maximum and minimum values
- Highest allocation (North America) = £5,400,000
- Lowest allocation (Latin America) = £1,200,000
- Calculation: £5,400,000 - £1,200,000 = £4,200,000