McKinsey Problem Solving Test
Free Practice Test

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FREE MCKINSEY PST

Instructions

This practice test contains 9 questions and we recommend you take 20 minutes to complete it. The actual test contains 26 questions and you will be given 60 minutes to answer as many questions as possible. This test assesses your ability to solve business problems using deductive, inductive and quantitative reasoning.

While completing this practice test do NOT use any electronic devices such as a calculator or computer when performing the calculations to answer the questions. Electronic devices will NOT be permitted during the actual test administration.

We also recommend you only use the blank space in this booklet to assist you in performing any calculations and recording any notes. Indeed, NO scratch paper will be allowed during the actual test administration.

You will be presented with a scenario based on a real business case. Information related to each scenario will be shown in text, tables and exhibits. This information is presented in shaded areas and is distributed in sections throughout the scenario. The questions ask you to find the most appropriate answer to the problem as described using only the information presented. You should select one and only one answer to each question.

This practice test begins on page 4 of this booklet. Only consider information contained within the scenario when determining your answer. Considering all information presented within the scenario is critical to answering questions correctly.

After completing the test, score your answers using the answer key located at the end of this booklet. Add the number of correct answers to determine your final score.

Answer sheet

Q1	A	B	C	D
Q2	A	B	C	D
Q3	A	B	C	D
Q4	A	B	C	D
Q5	A	B	C	D
Q6	A	B	C	D
Q7	A	B	C	D
Q8	A	B	C	D
Q9	A	B	C	D

easyAirways

easyAirways is a company that runs airline services across all major cities in Europe. Its main hub is located in the United Kingdom in London. *easyAirways* provides two types of services:

- **Passenger services**: *easyAirways* provides air transport services for passengers traveling between major capitals in Europe. Most of the company's flights link London to other urban centres.

- **Cargo services:** *easyAirways*'s cargo business is dedicated to the transportation of goods by air. The company operates fixed routes within Europe. Businesses purchase volume in its planes to have their goods transported between airports.

The company's passenger service was designed to offer low cost tickets on short haul European flights by cutting down on complimentary services such as drinks and food. It was initially targeted to young holidaymakers who are particularly price sensitive but, over the past few years, an increasing share of its passenger tickets has been sold to professionals as an economic crisis has hit Europe. As the company's ties with businesses have developed it has launched a new cargo service to transport goods between airports.

easyAirways has found that there are considerable variations in profitability between the different routes its operates as well as between its passenger and cargo businesses. Table 1 shows a summary of the analysis carried out by the CEO's team so far.

Table 1: Summary of data collected on three routes flown by *easyAirways*

From London to	**Paris**	**Barcelona**	**Frankfurt**
Passenger business			
Average passenger ticket price (one-way) (a)	£35	£50	£40
Number of return flights per month (b)	28	54	58
Number of seats per plane (c)	125	125	125
Net profit margin of passenger business	2%	4%	6%
Cargo business			
Average price per cubic meter (one-way) (d)	£30	£50	£45
Number of return flights per month (e)	20	40	80
Plane capacity in cubic meters (f)	150	150	150
Net profit margin of cargo business	0.5%	2%	2%

The founder of *easyAirways* has decided to sell his shares in the company on the stock market. In order to prepare for the company's IPO, he wants to optimise the profitability of all the routes operated by the airline. He has hired your team to study the company's portfolio of routes and to make recommendations to improve the least profitable routes.

1. Which of the following equations best approximates *easyAirways'*s weekly revenue, r, for each of the flights departing from London?

   A) r < 2 x a x b x c + 2 x d x e x f

   B) r = 2 x a x b x c + 2 x d x e x f

   C) r < (2 x a x b x c + 2 x d x e x f) / 4

   D) r = (2 x a x b x c + 2 x d x e x f) / 4

2. Based on the data presented in Table 1, which of the following statements CAN be concluded?

   A) The Barcelona route has the lowest revenue potential for the passenger business

   B) The Frankfurt route has the most actual profit across the passenger and cargo businesses

   C) The cargo business generates 10% more profit than the passenger business overall

   D) In these three cities, the passenger business delivers two to four times more profit per customer dollar spent than the cargo business

3. Which of the following statements, if true, would NOT help explain the differences in net profit margins for the passenger business across the three airline routes in Table 1?

   A) There are differing levels in the average airport charges and taxes per flight in the three routes

   B) The number of transportation options to reach the three cities from London differs

   C) There are differing levels in the average fuel cost per flight paid in the different cities

   D) There are differing levels in the average frequency of flights in the different cities

The team then decides to analyse the exact number of seats that needs to be filled for each flight to break even on the Paris route. They gather the following information about the flight's costs:

- The Paris route has got a dedicated crew of pilots and cabin attendants costing the airline £1.0 million per calendar year
- Over the past twelve months fuel costs have averaged out at £1,600 per flight from London to Paris, as well as from Paris to London
- The company leases the plane it uses for the Paris route for £20,000 per month
- All other airport and maintenance costs averaged out at £15,000 per month over the past twelve months

4. Assuming no other costs than those mentioned above, what is the SMALLEST number of passengers required for the airline to break even on a typical flight from London to Paris?

   A) 57

   B) 68

   C) 110

   D) 119

In an effort to improve the profitability of the Paris route, the team investigates different ways to increase the average number of seats filled in a typical flight. To achieve this, it analyses the results of a recent survey carried out by the *easyAirways* team. The survey was conducted at London Heathrow, the capital's largest airport, on randomly selected passengers. It focused on the London to Paris route and asked questions about passengers' awareness of *easyAirways* and whether they had flown this route with the company before. The results were split between holidaymakers and business travellers as presented in Table 2.

Table 2: Results of survey on holidaymakers and business travellers on *easyAirways* London to Paris route

	Holidaymakers	Business travellers
Total number surveyed	5,600	1,200
Total number aware of *easyAirways* flight to Paris	2,584	947
Total number considering using *easyAirways* flight to Paris in the next 12 months	1,128	788
Total number who used *easyAirways* flight to Paris in the past 12 months	890	712

5. What is the difference, in percentage points, between the awareness rate of holidaymakers and business travellers on the London to Paris route?

   A) 10 percentage points

   B) 16 percentage points

   C) 33 percentage points

   D) 38 percentage points

6. Which of the following reasons, if true, would NOT help explain why the number of business travellers who flew with *easyAirways* on the Paris route over the past 12 months is smaller than the number of holidaymakers in Table 2?

   A) Paris is more often visited on holidays than on business trips, on average

   B) Business class plane tickets are more expensive than standard economy plane tickets

   C) Business professionals have increasingly been using teleconferencing technologies

   D) Business travellers are more likely to own private airplanes than holidaymakers

The team then investigates if there is any scope to reduce costs at the airline. One of the CEO's questions is whether his team of aircraft maintenance engineers could be organised in a more cost efficient way than it currently is.

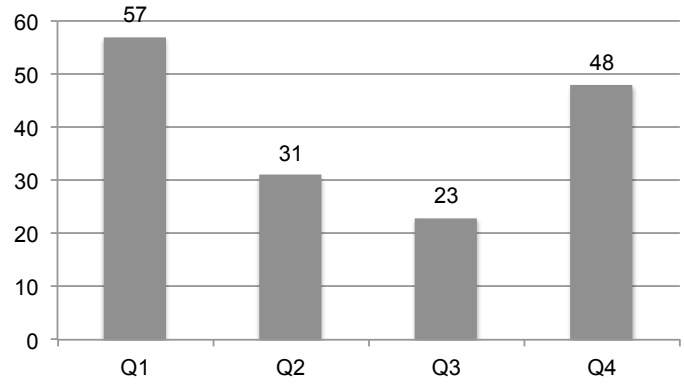
Aircraft maintenance engineers are licensed professionals who perform a series of tasks from an approved maintenance schedule to ensure the safety of the aircraft and its passengers. These tasks are typically carried out between a plane's landing and its next take-off. They include checking the tire pressure, inspecting fluid leaks, looking at potential damage to the aircraft structure, etc. The team is in charge of taking the necessary steps to restore the aircraft to safe condition before it takes off again.

During a discussion with the Chief Maintenance Engineer you find out the following information about the maintenance of aircrafts in London for the three routes displayed in Table 1:

- Senior maintenance engineers are not allowed to work more than 12 hours per day and 48 hours per week for safety reasons
- At least two senior maintenance engineers need to be on-site at all times to supervise the 10 junior engineers maintaining *easyAirways* planes
- On occasions, maintenance aircraft engineers need to work over time to deal with special maintenance operations
- Labour costs for maintenance operations amount to £4 million per annum for the three routes

Exhibit 1

Average number of special maintenance operations per quarter



7. Assuming a total quarterly number of maintenance operations of 390, what is the average percentage of special maintenance operations in Q1 and Q2?

   A) 11.3%

   B) 13.5%

   C) 16.0%

   D) 19.5%

8. Based on the information provided by the Chief Maintenance Engineer, which of the following statements is a valid conclusion?

   A) A total of eight senior maintenance engineers are sufficient to cover weekly shifts

   B) Special maintenance operations account for more than 15% of maintenance related labour costs

   C) Staff who are not senior maintenance engineers do not work more than 48 hours per week

   D) The majority of labour maintenance costs are for staff who are not senior maintenance engineers

9. Assuming that regular maintenance operations and special maintenance operations have the same labour costs and that the quarterly number of maintenance operations is 390, which of the following numbers is closest to the average labour cost of a special maintenance operation?

   A) £2,400 per special operation

   B) £2,600 per special operation

   C) £2,800 per special operation

   D) £3,000 per special operation

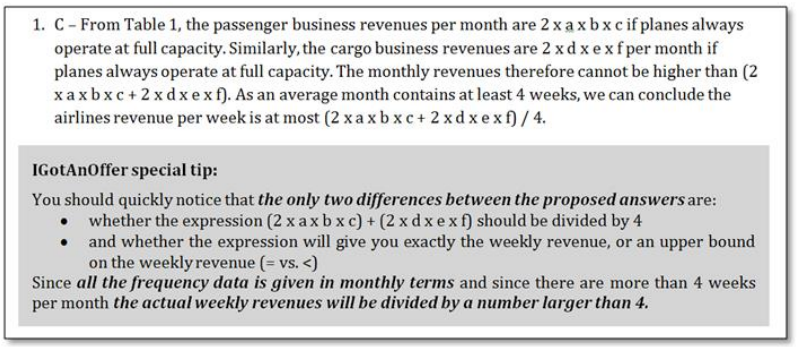
Submit

Answer key

Structure of answer key

Regular McKinsey PST answer →

IGotAnOffer special tips and detailed answers →



1. C – From Table 1, the passenger business revenues per month are 2 x a x b x c if planes always operate at full capacity. Similarly, the cargo business revenues are 2 x d x e x f per month if planes always operate at full capacity. The monthly revenues therefore cannot be higher than (2 x a x b x c + 2 x d x e x f). As an average month contains at least 4 weeks, we can conclude the airlines revenue per week is at most (2 x a x b x c + 2 x d x e x f) / 4.

IGotAnOffer special tip:

You should quickly notice that ***the only two differences between the proposed answers*** are:

- whether the expression (2 x a x b x c) + (2 x d x e x f) should be divided by 4
- and whether the expression will give you exactly the weekly revenue, or an upper bound on the weekly revenue (= vs. <)

Since ***all the frequency data is given in monthly terms*** and since there are more than 4 weeks per month ***the actual weekly revenues will be divided by a number larger than 4.***

We have just introduced “IGotAnOffer special tips” and “IGotAnOffer detailed answers” to the Free McKinsey PST. These new features aim to show you how we would have approached each question, while the “Regular McKinsey PST answers” just provide you with the right answer.

We want to know how useful you find these new features before rolling them out to our other McKinsey PSTs. If you liked this free PST, please take a few seconds to answer the question below and then click the “Submit” button. Thanks!

How valuable do you find the “IGotAnOffer special tips” and “IGotAnOffer detailed answers”?

Hate them		***Nice to have***		***Love them***
1:☐	***2:***☐	***3:***☐	***4:***☐	***5:***☐

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2. D – Profit per customer dollar spent is the same as profit margin. Table 1 shows that, on these three routes, the passenger business generates at least twice as much profit as the cargo business (Barcelona route) and at most four times as much (Paris route).

IGotAnOffer detailed answer:

This type of question is best handled by proceeding by elimination.

A quick glance at the table tells you that the Barcelona route sells more expensive tickets and has more flights per month than the Paris route. Therefore, it cannot possibly have the lowest revenue potential. ***You can eliminate option A***.

Option B requires you to estimate actual profits. However, you are missing one crucial data point to calculate actual profit: *plane occupancy rate*, that is, the number of passengers who actually book tickets on each flight – which might differ from total plane capacity. ***You can eliminate option B.***

Option C is more difficult to estimate, since some numbers are higher for the cargo business while others are higher for the passenger business. **You should therefore have a look at option D before diving into a long set of calculations**.

Customer dollar spent is the same as revenue, and profit per revenue is profit margin. ***You can see immediately that answer D is correct*** by comparing the profit margins of the two businesses across the three different routes. There is therefore no need to return to option C.

3. D – The frequency of flights does not provide information about the profitability of a given route. A high frequency of flights combined with a very large passenger demand could mean that the profitability of the route is still significant. Options A and C directly provide information on the costs of the different routes and could therefore be useful to understand profitability. Option B could provide information on competition on certain routes, which has got an impact on prices and profitability.

IGotAnOffer special tip:

Some questions are phrased ***negatively*** in the PST. For instance here you are asked to find which statement " would NOT help explain…" Thinking in negative terms is harder than thinking in positive terms. We therefore suggest that you ***rephrase negative questions as positive ones***. Here, you should ask yourself: 'does the information provided in the answer explain the difference in net margin between the different routes?'

Option D is the only option that does not explain the difference in margin, as frequency and profits are not linked in an obvious way. So this information would not help explain different profit margins.

4. C – The crew costs per year are £1,000,000. The fuel costs per year are equal to the total number of flights (twice the number of return flights) times the average cost per flight times 12, or 2 x 28 x £1,600 x 12 = £1,075,200. Other costs add up to £35,000 per month, or £420,000 per year. For the route to break even, the average number of passengers per flight must therefore be (Costs) / (Price per ticket x Number of return flights per month x 2 x 12) = (1,000,000 + 1,075,200 + 420,000) / (35 x 28 x 2 x 12) = 106.1. The smallest number of customers required is therefore 110.

IGotAnOffer detailed answer:

The answer to this question is difficult to estimate by doing mental maths. In this situation, it is worth writing out a formula of what you want to calculate. This is both to minimise the risk of error and the number of calculation steps you will do. Here, the firm breaks even if **Costs =Revenues**.

You are looking for the number of passengers that will make the firm break even on the Paris route. Notice that revenue data is given to you on a per passenger basis, while costs are given on a total or per flight basis. Therefore, breaking even requires that:

$$\text{(Total costs)} = \text{(Revenue per passenger)} \times \text{(Number of passengers)}$$

It follows that:

$$\textbf{Number of passengers to break even} = \frac{\textbf{Total costs}}{\textbf{Revenue per passenger}}$$

Since some data is annual, and some is monthly, ***you have to convert all of it to the same time frame***. While most of the information is monthly data, it is easier to multiply by 12 than to divide by 12. You should therefore convert everything into yearly data. Total costs are the sum of yearly crew costs, yearly fuel costs, yearly lease costs and yearly airport costs:

$$\text{Total costs} = 1{,}000{,}000 + (2 \times 28 \times 1{,}600) \times 12 + (20{,}000 \times 12) + (15{,}000 \times 12)$$

To minimise the number of calculations, factorise the 12 out of the last three terms and first calculate the sum: $(2 \times 28 \times 1{,}600) + 20{,}000 + 15{,}000$.

For the first term, you can mentally calculate $2 \times 28 = 2 \times 20 + 2 \times 8 = 40 + 16 = 56$, and then calculate $1{,}600 \times 56$ on paper to avoid mistakes. This should give you 89,600.

Add $20{,}000 + 15{,}000 = 35{,}000$ to 89,600, mentally or on paper depending on how comfortable you feel about this calculation and you should get 124,600.

Finally, multiply this number by 12 and you will get $124{,}600 \times 12 = 1{,}495{,}200$ for the last three terms.

Add the 1,000,000 in the first term and you will find total costs of:

$$\text{Total costs} = 1{,}000{,}000 + 1{,}495{,}200 = 2{,}495{,}200$$

Annual revenues per passenger are given by:

$$(\text{Price of one way ticket} \times \text{Number of return flights per month} \times 2) \times 12$$

Using data from Table 1, this number is $35 \times 28 \times 2 \times 12 = 35 \times 56 \times 12 = 420 \times 56$. The last step should be done on paper to avoid mistakes. It will give you 23,520. All what is left to do now is:

$$\text{Number of passengers to break even} = \frac{2{,}495{,}200}{23{,}520}$$

If you do this calculation on paper, it will give you: 106.1. ***However, this is a very tedious calculation to make.*** To save time, have a look at the options provided: 57, 68, 110, 119, and notice that this division is very close to $2500/24$, which is greater than 100 and less than 110. Therefore, you can conclude that ***the correct answer is 110, option C.***

If time permits, you can check that indeed $23{,}520 \times 110 = 2{,}352{,}000 + 235{,}200 = 2{,}587{,}200$. Therefore, 110 passengers would be enough to cover the costs. Note that 119 passengers would also cover the costs but you are asked for the *minimum* number of passengers to break even.

5. C – The awareness rate for a given route is given by the ratio of people aware of *easyAirways* over the total number of people surveyed. The awareness rate of the holidaymakers' category is 2,584 / 5,600 = 46%. The awareness rate of the business travellers' category is 79%. The difference between the two awareness rates in percentage points is therefore 33%.

IGotAnOffer special tip:

For this kind of question, the key is to determine whether you want to estimate the result or to do a precise calculation. Take a look at the answers given; if they are very close to one another, you will need to do the long divisions on paper. ***If the options are sufficiently far from one another, you should estimate the answer by doing mental maths.*** Here, the options are close to one another and there are only three precise calculations to do. You should opt for a precise calculation.

6. B – Option B would not help explain why the number of business travellers who flew with *easyAirways* on the Paris route over the past 12 months is smaller than the number of holidaymakers because it does not provide information on this category of customers. Indeed, the proportion of business class tickets respectively bought by holidaymakers and business travellers is unknown.

IGotAnOffer special tip:

For this question, take the same approach as in question 3: ***rephrase the question in a positive way***. For each option, ask yourself if it explains why the number of business travellers is smaller than the number of holidaymakers.

7. A – Assuming a total quarterly number of maintenance operations of 390, the percentage of special maintenance operations is 14.6% in Q1 (57 / 390) and 7.9% in Q2 (31 / 390). The average of Q1 and Q2 is therefore closest to 11.3%.

IGotAnOffer special tip:

Again here, you should ask yourself whether the best strategy is ***to approximate or to do exact calculations***. The options are fairly close to one another and there are only three calculations to do. ***You should once again opt for precise calculations***: all you need to do is calculate the ratio of special operations to total operations for quarter 1 and for quarter 2 and then take the average of these two numbers.

This question relies on you noticing the difference between '*maintenance operations'* and '*special maintenance operations'*. Exhibit 1 gives you the number of '*special maintenance operations'* per quarter, while the question gives you the total number of *'maintenance operations'*.

8. A – Senior maintenance engineers are not allowed to work more than 12 hours a day and 48 hours per week for safety reasons. In addition, at least two senior engineers need to be on site at all times. To cover the site 24 hours a day for 7 days a week with two engineers, a total of 336 hours of work are required (7 x 24 = 336). Since engineers cannot work more than 48 hours a week, at least 7 of them are needed (336 / 48 = 7). In addition, there should be enough engineers to cover 28 half-day shifts per week (4 shifts per day). Four engineers are sufficient to cover Monday to Thursday shifts. An additional four engineers are also sufficient to cover the remaining Friday to Sunday shifts. A total of 8 engineers are therefore sufficient to cover the week.

IGotAnOffer detailed answer:

This is primarily a logic question, despite the computations that seem required. Before rushing to do long calculations, evaluate which answers can be eliminated straight away. First notice that ***all the information you need is included in the last four bullet points*** of the description and in the table.

You have ***sufficient information to check whether option A is correct***. However, it is faster to first eliminate other answers. You can return to the details of option A later if necessary.

Option B cannot be evaluated using the information given. You know the number of special maintenance operations as a percentage of total maintenance operations on average, and you know the total labour cost for maintenance operations, but ***you do not know whether an average special maintenance operation costs the same as an average maintenance operation***. In particular, if engineers have to work overtime, these costs might very well be different. You can eliminate option B.

Option C can also be eliminated: you are given restrictions on how many hours *senior* maintenance engineer can work a week, but ***no information about how many hours other staff can or do work***. The key thing is to pay attention to the details of the wording, such as '*Staff who are* ***not*** *senior maintenance engineers'*.

Option D can also be discarded. You know that you need at least two senior maintenance engineers for ten junior engineers, but it could be the case that the airline has more than two of them. In addition, ***you have no information about the relative costs of senior engineers and junior engineers***, so you cannot draw any conclusion about the relative total costs of the two types of workers.

This leaves only option A as a possible conclusion. In the interest of time, you should tick that answer straight away. If you do not feel sufficiently confident about eliminating the other answers, you can check that indeed you need at least eight senior maintenance engineers to cover all the shifts.

9. B – Assuming 390 operations per quarter, the yearly total number of operations is 1,560. The total cost of maintenance is £4 million. Since special maintenance operations and regular maintenance operations cost the same, the cost per special operation is the same as the cost per operation which is given by £4,000,000 / 1,560 or £2,564. The closest number among the options given is £2,600.

IGotAnOffer special tip:

In this question, the difficulty lays in the logic you need to use and not so much in the calculation. You are told that regular maintenance operations and special maintenance operations cost the same. From this you can deduce that ***the average cost of a special maintenance operation is the same as the average cost per operation across all types of operations***.

You can therefore calculate the average cost per operation across all types of operations using the following information: total yearly cost per operation and average quarterly number of operations, across all types of operations. Therefore, all you need to calculate is:

$$\text{Average cost of a special maintenance operation} = \frac{\text{Total yearly costs of all maintenance operations}}{\text{Total number of maintenance operations per year}}$$