

RELEVANT TO CAT QUALIFICATION PAPER 10

Interpreting breakeven and profit-volume charts

I commented in my examiner's report on the December 2010 exam that in Question 4, Part (b), the vast majority of students drew a breakeven chart rather than a profit-volume chart. This is either because candidates misread the requirement, or because there is a lack of understanding of the difference between the two types of chart. In addition, candidates showed a lack of understanding in Question 4, Part (c), as to what the profit-volume line actually showed, and therefore how a change in one variable – in this case, the fixed costs – would affect the profit-volume line.

The study sessions 19 (b) and (c) of the syllabus state respectively that candidates must be able to:

- analyse the effect on the breakeven point of changes in sales price and costs
- prepare and explain the breakeven charts and profit-volume charts.

It is not enough just to be able to 'mechanically' draw a breakeven or profit-volume chart; candidates must fully understand what the lines represent, how a change in a variable will affect the lines and the breakeven point, and how to interpret the charts. This article aims to aid candidates' understanding of these areas.

BREAKEVEN CHART

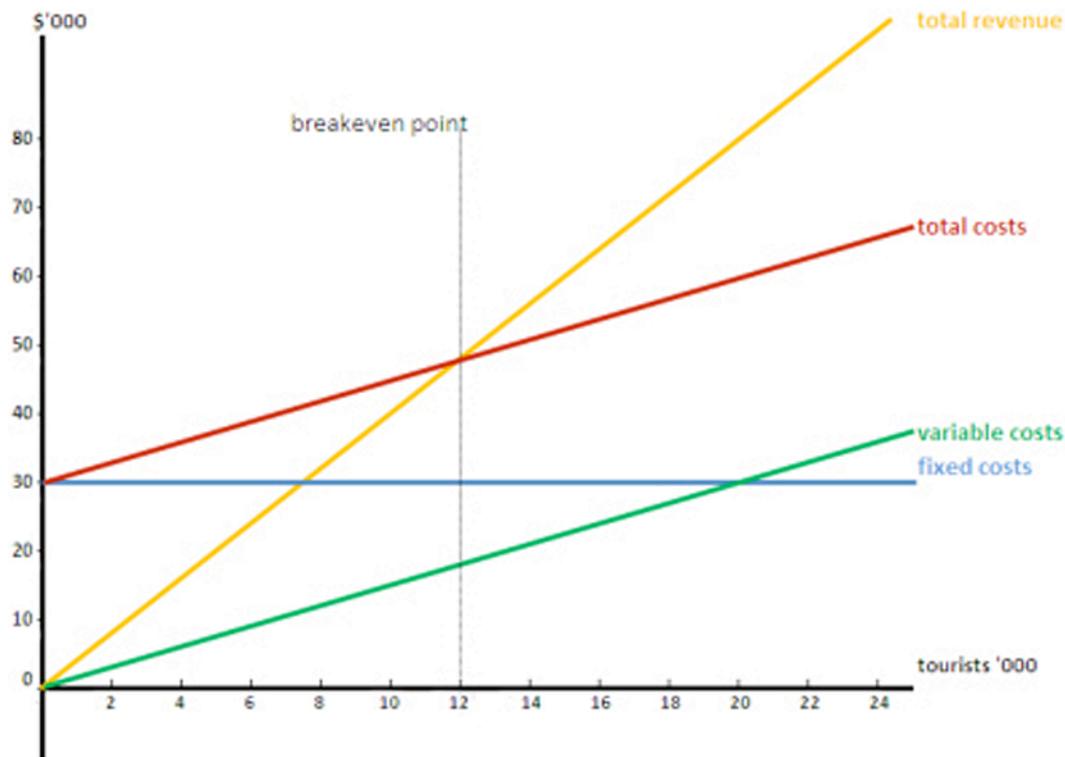
Let's use the information from the December 2010 exam that was either given in the question, or required to be calculated in Part (a):

Fee per tourist	\$4.0
Variable cost per tourist	\$1.5
Contribution per tourist	\$2.5
Fixed costs	\$30,000
Breakeven point	12,000 tourists

It is perfectly possible to draw a breakeven chart with this information. The sales revenue, variable costs and fixed costs can all be plotted and the breakeven point of 12,000 tourists shown.

INTERPRETING BREAKEVEN AND PROFIT-VOLUME CHARTS

APRIL 2011



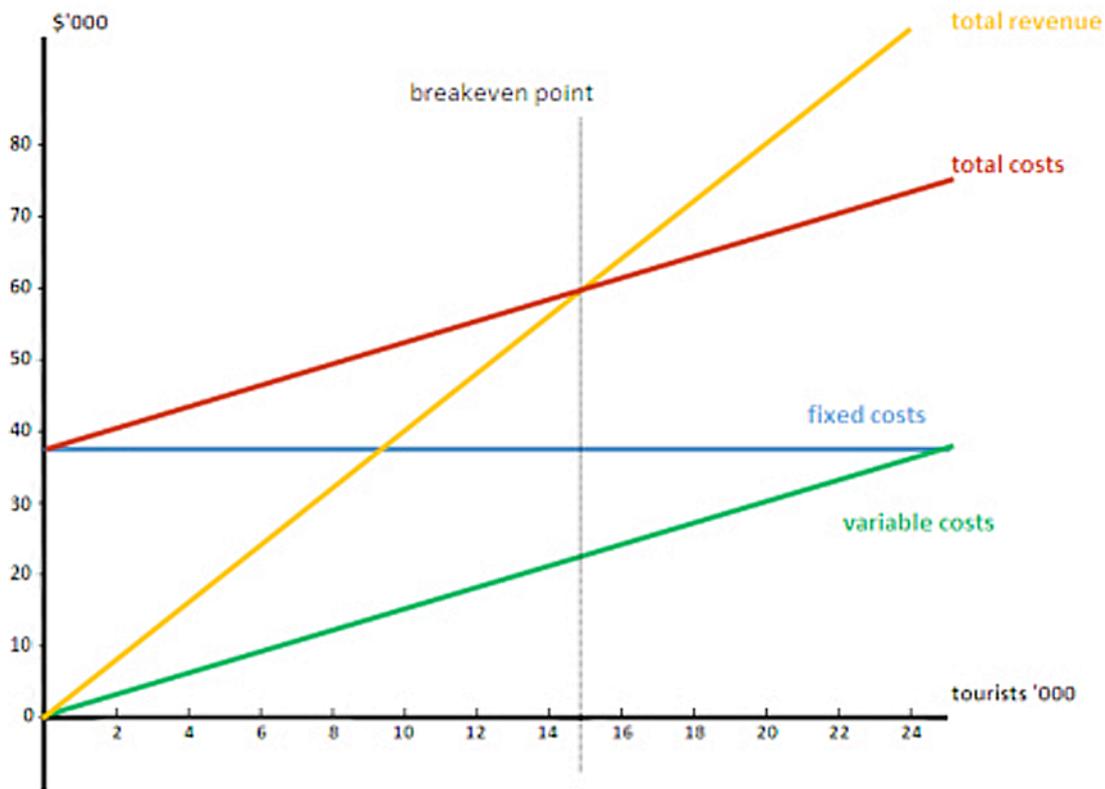
Note how the axes are labelled – the vertical axis shows dollars (\$) and the horizontal axis shows output/sales, which in this case is the number of tourists. It is important that candidates label the axes if they are drawing a chart in an exam question. Candidates need to be able to explain what will happen to the lines on the chart, and the breakeven point, if costs or revenue change.

What if fixed costs increase?

If fixed costs increase by \$7,000 as happened in Part (c) of this question in the December 2010 exam, the horizontal fixed cost line will move up to \$37,000. This will have a knock-on effect to the total cost line – its intersection with the vertical axis will now start at \$37,000, rather than \$30,000. Note that there has been no change in the variable cost per unit, so the slope or gradient of the variable cost line will not change and, therefore, the slope or gradient of the total cost line will not alter, only the point of intersection on the vertical axis. Revenue has not been affected, and so this line will not change.

INTERPRETING BREAKEVEN AND PROFIT-VOLUME CHARTS

APRIL 2011



It is now possible to identify the new breakeven point of 14,800 units.

It is worth checking whether this new breakeven point makes sense intuitively. The breakeven point has increased – ie we need to take more tourists in order to be in a position of nil loss/nil gain. Does this seem reasonable? The answer is yes. The fixed costs have risen, and Joe will need to take more tourists out on his boat to earn the extra contribution required to cover the increased fixed costs.

It is always worth taking a minute in questions to see if the new breakeven point makes sense intuitively. By doing this, you should be able to spot if you have made a silly error either in your calculations or in drawing your graph.

Let us look at what happens to the breakeven chart and point if other variables change. (Note that I will always start with the data as per the original question as my base position.)

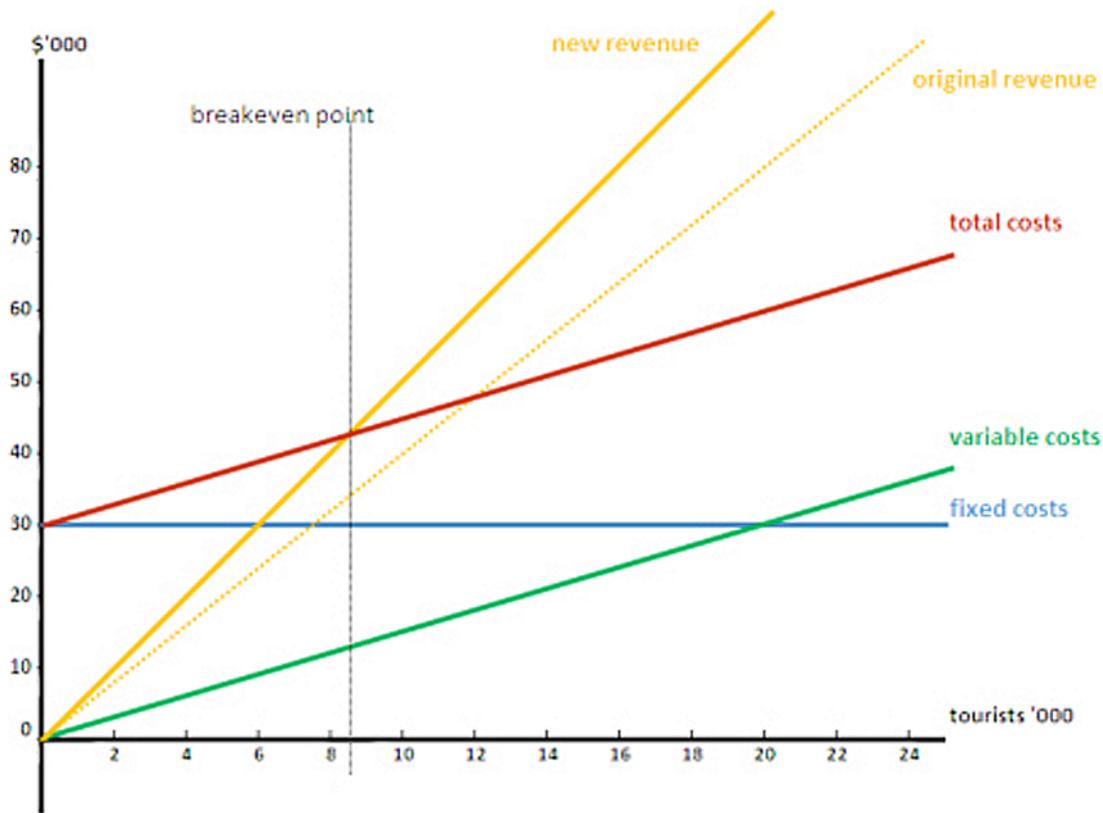
What if the sales price per unit had changed?

In this case, all the cost lines would remain the same – only the total revenue line would be affected, which would in turn affect the breakeven point.

Before looking at the effect on the graph, let us think intuitively about what an increase in sales price or, in this case, fee per tourist would mean to Joe. What if the fee per tourist went up to \$5? Joe would earn more contribution per tourist (\$3.5) and would therefore need to take fewer tourists out in order to cover his fixed costs of \$30,000.

INTERPRETING BREAKEVEN AND PROFIT-VOLUME CHARTS

APRIL 2011



Again the new breakeven point of 8,571 can be read from the chart.

It follows that if the sales price per unit had fallen, Joe would earn less contribution per tourist taken, and therefore have to take more tourists out on his boat in order to cover his fixed costs – ie the breakeven point would have risen.

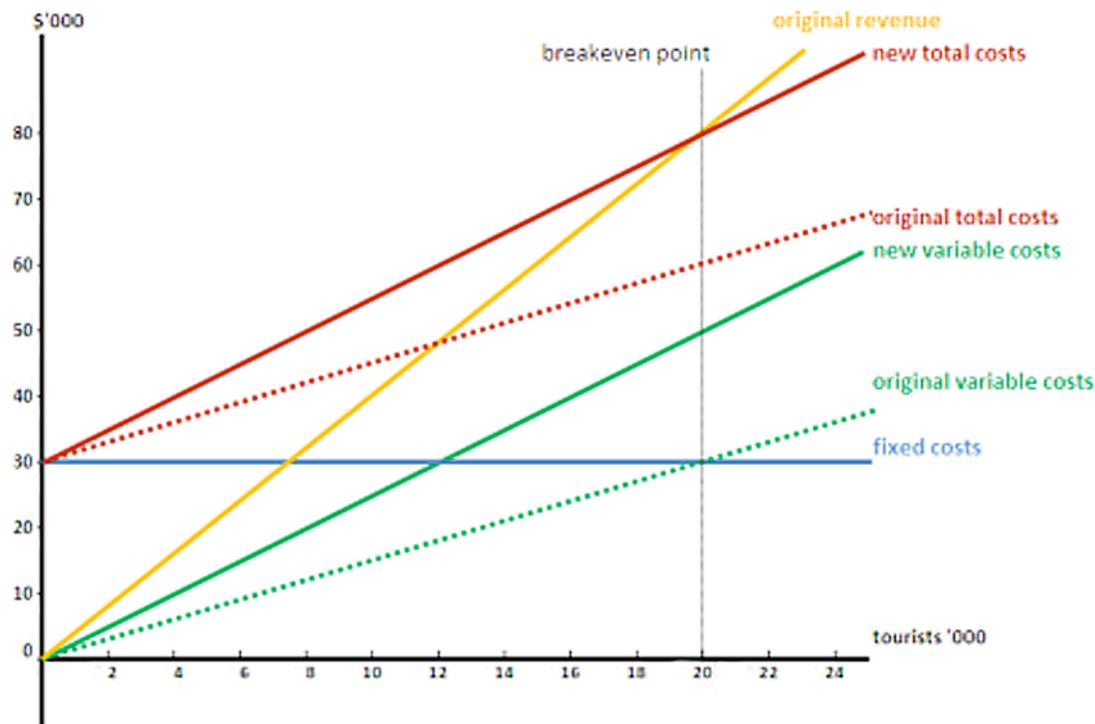
What if the variable cost per unit had changed?

In this scenario, the gradient of the variable cost line would alter, which would then affect the total cost line and the breakeven point.

Again, thinking intuitively, what would happen if Joe's variable costs increased to \$2.5 per tourist? In this case, Joe would earn less contribution per tourist – only \$1.5 (\$4 – \$2.5) – and so he would have to take more tourists out in his boat in order to earn the contribution to cover fixed costs of \$30,000.

INTERPRETING BREAKEVEN AND PROFIT-VOLUME CHARTS

APRIL 2011



In the graph above, the new breakeven point is 20,000 units.

PROFIT-VOLUME CHART

Now we will use the same information to consider profit-volume charts:

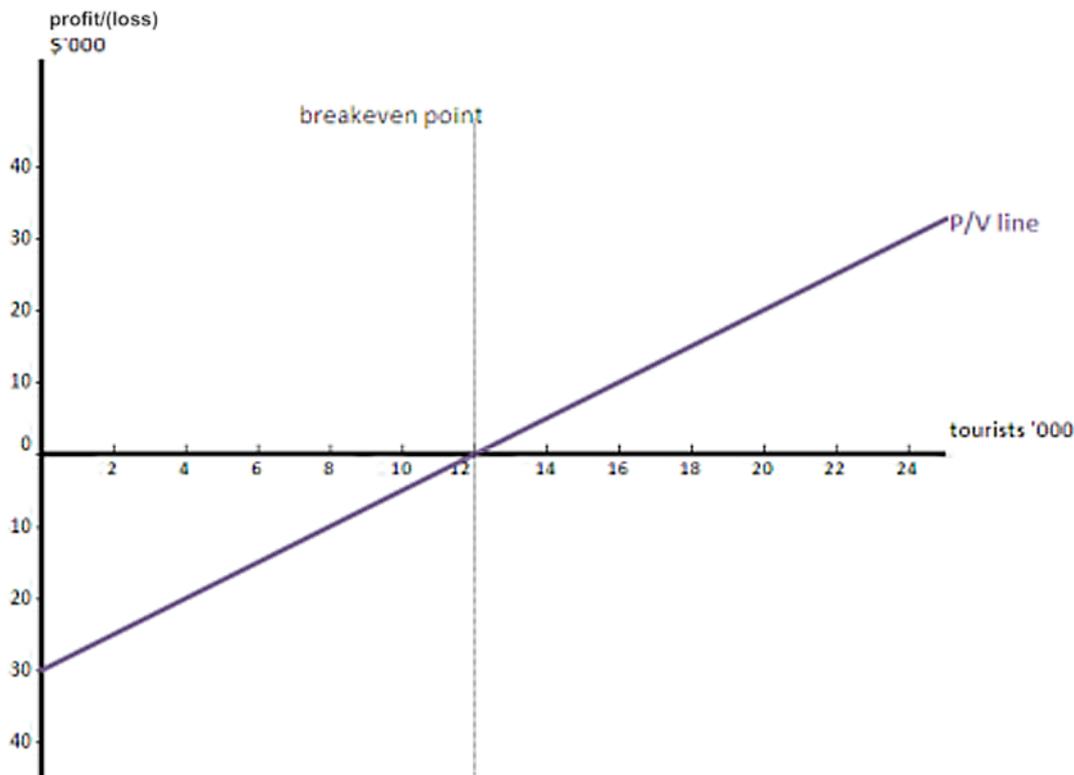
Fee per tourist	\$4.0
Variable cost per tourist	\$1.5
Contribution per tourist	\$2.5
Fixed costs	\$30,000
Breakeven point	12,000 tourists

It can be argued that a profit-volume chart is easier to draw, as you only need to be able to plot two points in order to draw the profit-volume line. The two points can be any two of the fixed costs, the breakeven point, or a profit figure at a certain level of output.

Using the information above and plotting the fixed costs and breakeven point, the profit-volume chart appears as follows:

INTERPRETING BREAKEVEN AND PROFIT-VOLUME CHARTS

APRIL 2011



Note how the axes are labelled for a profit-volume chart. The horizontal axis is still the number of tourists, but the vertical axis is now profit/loss in dollars (\$).

The intercept on the vertical axis shows the level of fixed costs, and where the line crosses the horizontal axis represents the breakeven point – ie where profit is zero. The gradient of the line represents the contribution per unit.

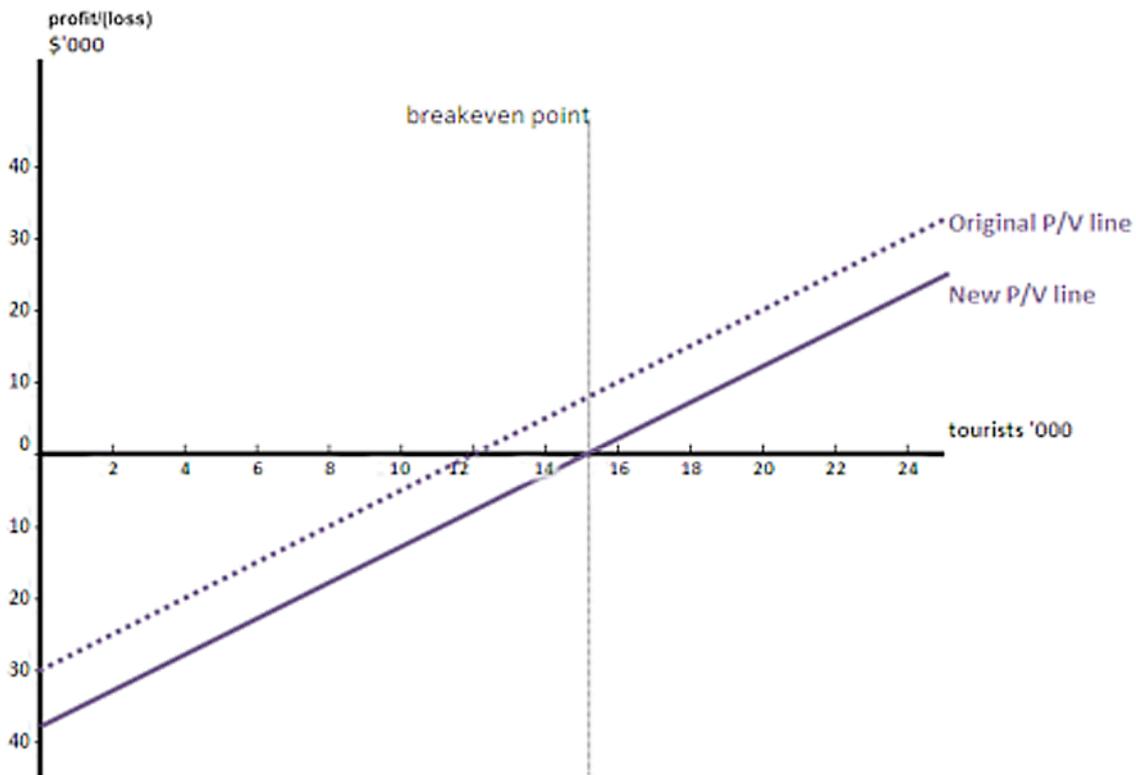
Let us look at what happens to the profit-volume chart and if variables change. (Note that I will again always start with the data as per the original question as my base position.)

What if fixed costs increase?

If the fixed costs increase to \$37,000, the intercept on the vertical axis will change to reflect the increased costs (it will move to the new fixed costs of \$37,000). However, neither sales revenue per unit (fee per tourist) or variable cost per unit have altered. The contribution per unit has not altered and, therefore, the gradient of the profit-volume line will not alter. It is therefore possible to draw on the new profit-volume line by keeping the same gradient but changing the point of intersection on the vertical axis.

INTERPRETING BREAKEVEN AND PROFIT-VOLUME CHARTS

APRIL 2011



The new breakeven point can be read from the chart as 14,800 units.

What if the sales price per unit had changed?

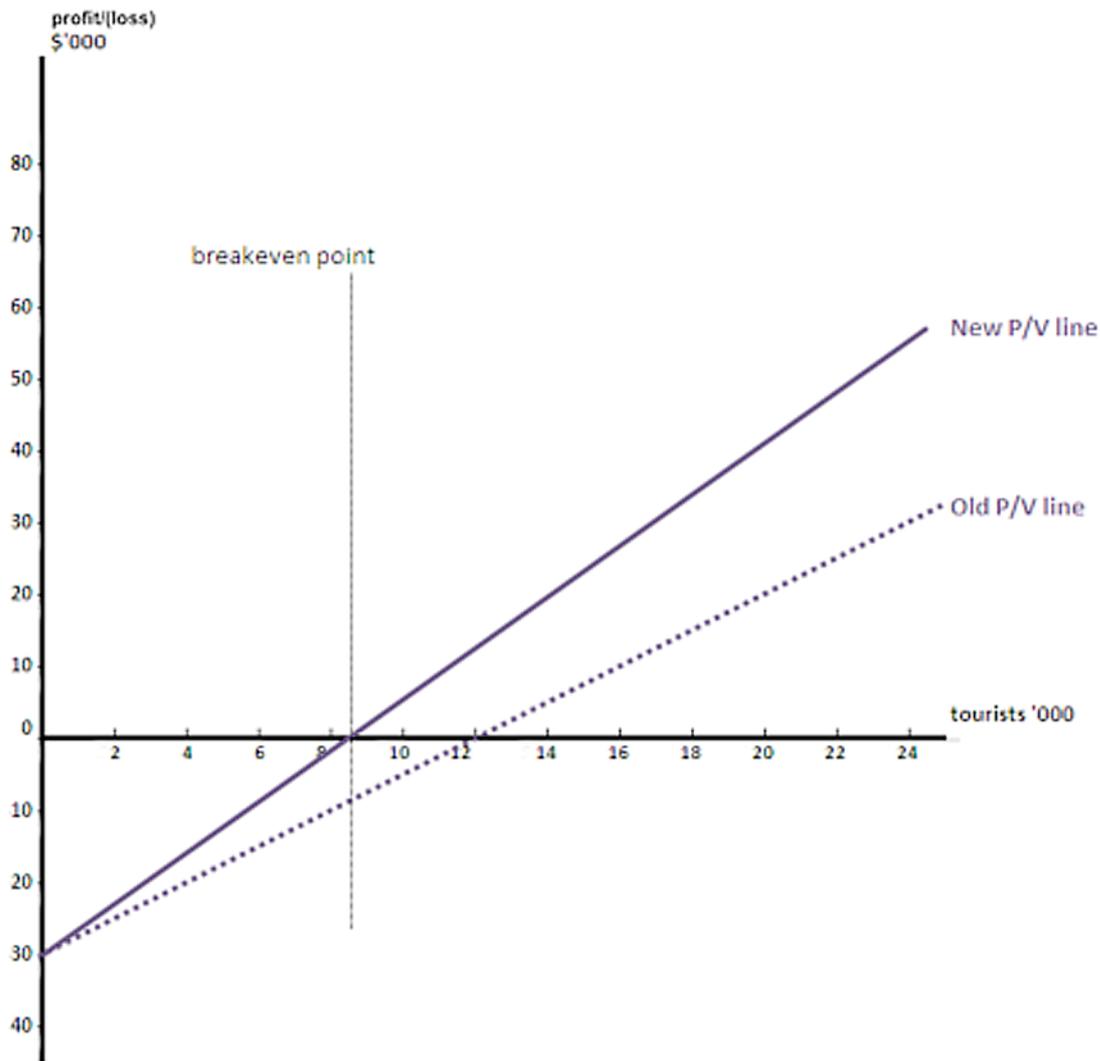
In this case the total fixed costs do not change, and therefore the intercept on the vertical axis will not change. However, the contribution per unit will change and, therefore, the gradient of the profit-volume line.

We know intuitively that if the sales price goes up to say \$5 per tourist, then the breakeven point will decrease (see earlier), so this means that the intercept on the horizontal axis will be nearer the origin. By how much though? Where is the new breakeven point?

You can either calculate the new breakeven as being $\$30,000 / \$3.5 = 8,571$ units, or you can calculate the profit that will be earned at an output level. For example, the profit earned if 10,000 tourists are taken out will be $10,000 \times (\$5 - \$1.5) - \$30,000 = \$5,000$. Plot the \$5,000 profit on your graph and then read off the new breakeven point.

INTERPRETING BREAKEVEN AND PROFIT-VOLUME CHARTS

APRIL 2011



What can be seen from the graph is that a change in sales price affects the gradient of the profit-volume line only – not the intercept on the vertical axis – because fixed costs have not altered.

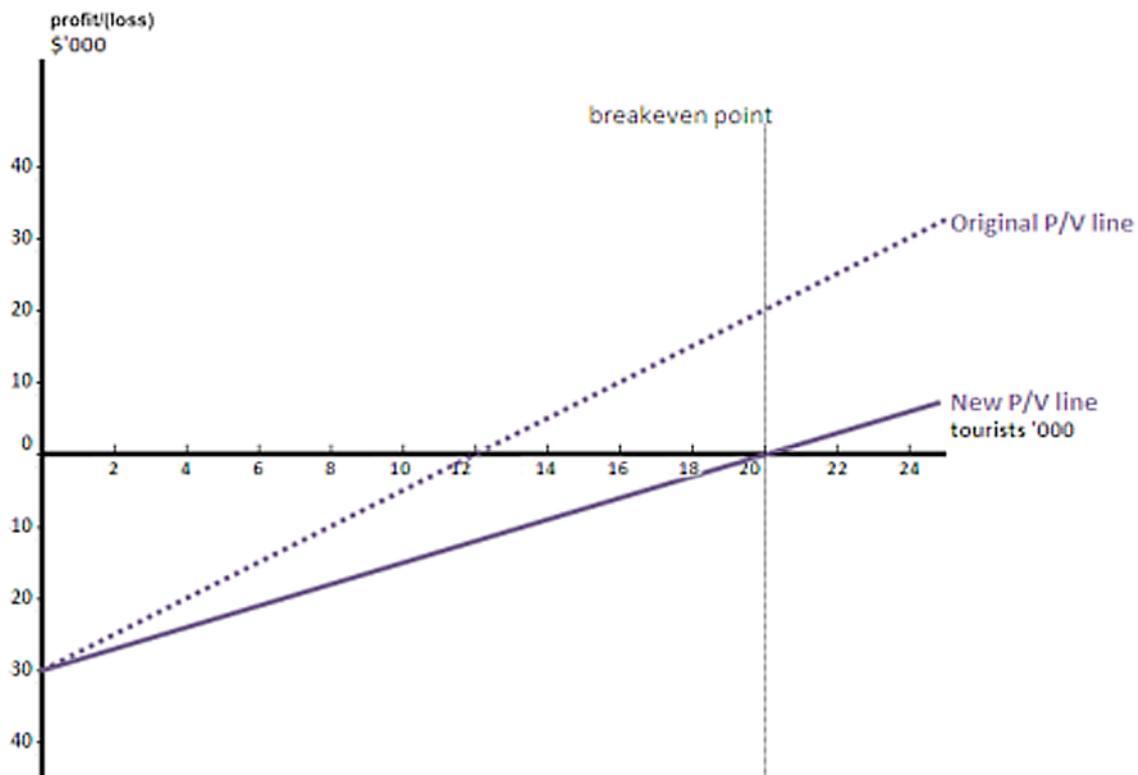
What if the variable cost per unit had changed?

The same is true if the variable cost per unit is altered. The intercept on the vertical axis will not change because fixed costs have not altered, only the gradient of the profit-volume line, as the contribution per unit has again altered.

Using the figures we had earlier when we considered a change in variable cost per unit under the breakeven section, the new contribution per unit was \$1.5, so the profit/(loss) at 10,000 units would be $10,000 \times \$1.5 - \$30,000 = (\$15,000)$. Knowing the fixed costs and profit at 10,000 units allows the profit volume line to be plotted and the new breakeven point read off the graph. Again, it would have been possible to calculate the new breakeven point as 20,000 units and plot this, along with the fixed costs of \$30,000, in order to draw the new profit-volume line.

INTERPRETING BREAKEVEN AND PROFIT-VOLUME CHARTS

APRIL 2011



CONCLUSION

It is important that candidates understand how a chart – whether breakeven or profit-volume – is constructed, what the lines represent, how a change in a variable will affect the chart and the breakeven point, and therefore be able to interpret the charts.

Candidates must not draw the charts ‘mechanically’ but also think intuitively about whether the graphs and the answers that they have given are reasonable.

It is hoped that this article will help with some of these elements.

Charlotte Bower is examiner for CAT Paper 10