Costing and Break-Even Analysis

Specification Requirements- Classify costs: fixed, variable and semi-variable.
Construction and interpretation of break-even charts.
***What-if* analysis.**
The nature and significance of contribution.
The impact of changes in costs and revenue on a businesses's gross and net profit.

Types of Costs.

Fixed Costs

In business some costs will remain the same whatever the level of output produced or sold. For a shop, even if no customers visit, the rent or mortgage will have to be paid, there will still be business rates to pay, the electricity for lighting, fridges etc, will still have to be paid. These are all fixed costs. Fixed costs are costs that do not vary with output, no matter how much is made, or how little is sold, they still have to be paid.

Variable Costs

With variable costs the reverse is true. Variable costs vary in direct proportion to output, as output increases variable costs increase, as output falls variable costs fall. Using the example of a tailors shop, variable costs would include cloth, cotton, buttons etc. None of these raw materials of the suits or dresses made, would be used if no goods were produced. So when output or sales are nil, then variable costs are nil. But as soon as output starts then these raw materials start being used, as more and more suits and dresses are made, so more and more cloth buttons and cotton are used. We can therefore say that at output nil variable costs are nil, but as output rises variable costs rise.

Semi-variable Costs

Semi-variable costs are costs that are made up of two cost components - a fixed component and a variable component. Such costs vary with output or increased business activity, but not in direct proportion to it. For example, a firms electricity bill may include elements that are fixed (such as lighting that is required regardless of the level of production) and elements that are variable (such as the electricity used by machinery directly involved in manufacturing).
Other typical examples of semi-variable costs include,
Sales staff earnings – where income paid by the firm to the employee will be divided between a basic salary earned at all times and commission earnings based on sales
Maintenance - maintenance can be of the regular, planned type, (e.g. weekly, monthly, or annual service maintenance) the cost of which is independent of levels of production or activity and therefore fixed, and production or activity-based maintenance (e.g. 5,000-mile service for vehicles, and breakdowns due to worn-out parts) the costs of which are directly dependent on activity and therefore are variable costs.

Break—Even Analysis

For many new businesses, and for those considering expanding, it is essential to know at what level of output or sales the firm will begin to make a profit. Break-even analysis allows calculation of the level of output or sales where firms start to make profits, and the likely amounts of losses or profits at differing levels of output and sales.

The graphical method of break-even analysis.

As the name implies, the graphical method of break-even analysis involves drawing graphs. So to complete this method, we must draw a break-even chart, this will normally be done on graph paper. When preparing your break-even graphs be careful to draw your lines as accurately as possible, as small errors could mean that marks are lost! In an exam you will be given a part prepared break-even graph, with axis drawn and labelled, you may be given the total amount of fixed costs, the horizontal fixed cost line drawn for you, plus the revenue or total costs line (all shown on the following pages),it depends on how helpful the examiner wants to be, or which aspect of your understanding is being tested.

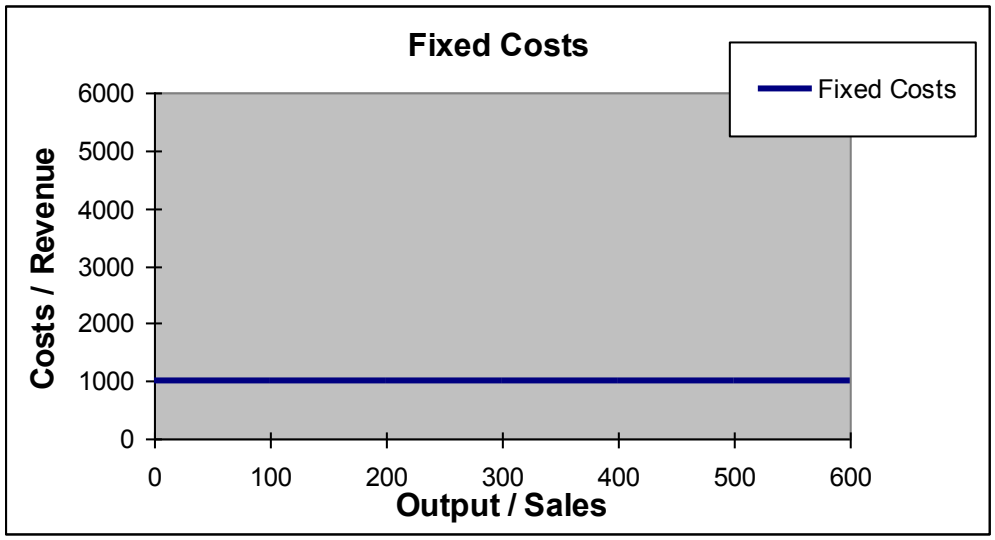
To demonstrate the graphical method of break-even analysis this method we will an example business.

CD Racks for ALL

CD Racks for All, produce wooden CD racks which are sold for £10, their costs are given below.
Fixed Costs.
Rent £2000 year
Salaries £8600 year
Rates £1000 per year
Bank interest on loan £50 per month.

The variable costs per unit made for CD Racks for All are given below.
Wood £2.20
Glue £0.60
Packaging £1.20
Labour £2.00

Remember, if you are asked to calculate fixed costs you must total all costs that do not vary with output. You must also ensure that the fixed costs total is relevant to the time period that you are calculating break- even output for. For example you may be asked to calculate break-even output per month, when some of the fixed cost figures are per year.



Fixed Costs.	**Monthly Fixed Costs**
Rent £2000 year	**£2000/12 = £166.67**
Salaries £8600 year	**£8600/12 = £716.67**
Rates £1000 per year	**£1000/12 = £83.33**
Bank interest on loan £50 per month.	**£50.00**

Total Fixed Costs per month £1016.67

The Fixed Costs Line.
For our CD business we are asked to calculate break-even output per month, so as with the mathematical method, we must divide our costs into fixed and variable.
In this case the work has been done for us, our costs have already been broken down. But we must calculate the monthly costs as we have been asked to calculate monthly break-even output/sales.

On the graph you can see that the vertical axis shows us the level of costs and revenue and the horizontal axis the level of output and sales.

We can now draw the fixed costs line on the break–even chart.
We can see on the above chart, the fixed costs line which has been drawn at a level of £1016 for all levels of output. As fixed costs remain unchanged at all levels of output, the fixed costs line will always be horizontal.

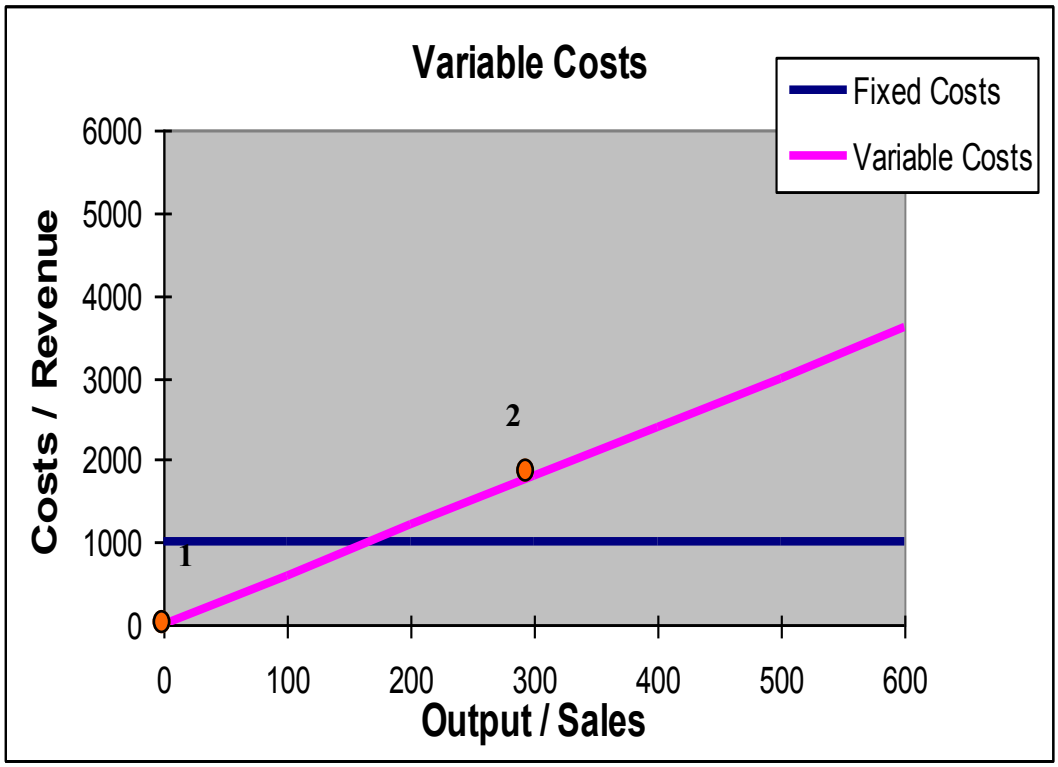
Adding the Variable Costs Line.
The next step is to add the variable costs line. When calculating variable costs we must work out the variable cost per unit made. The unit in this case is the CD rack.

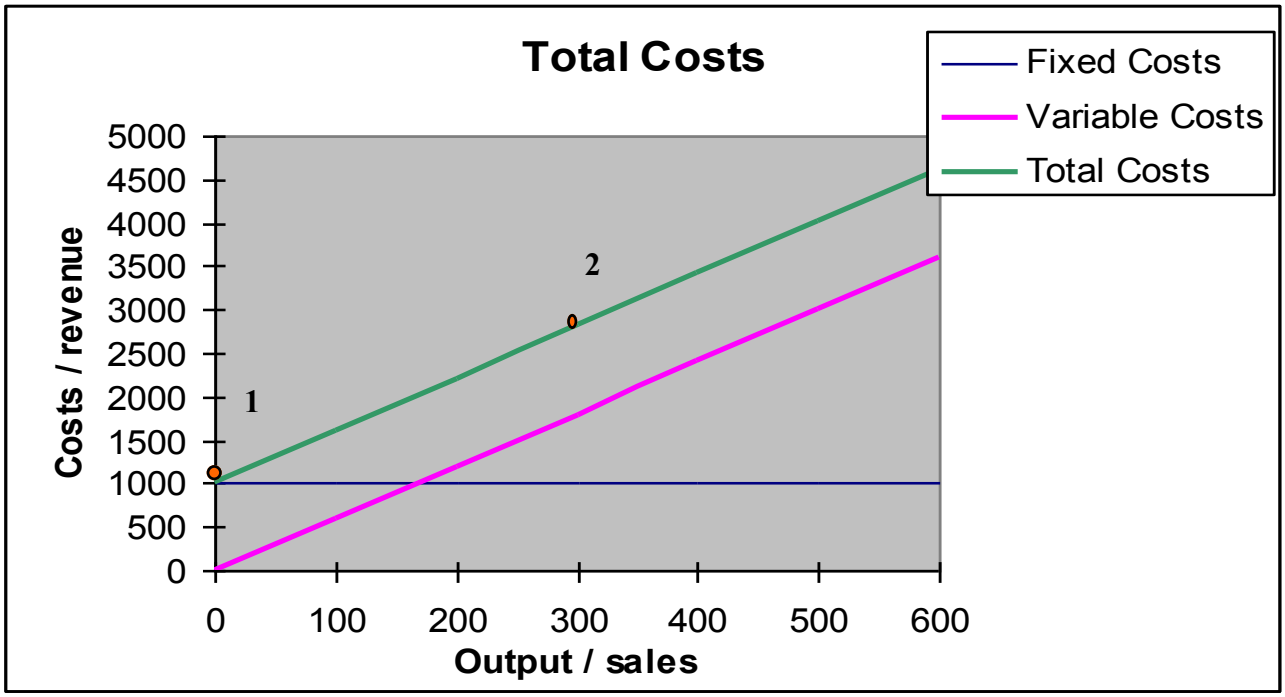
Method
To draw the variable cost line we must mark two points. We know that at output nil variable costs are nil, so we have our first point: nil output, nil costs, the point where the axis meet.
Marking the second point is a little more difficult. First a level of output must be chosen that allows an accurate line to be drawn. There is no point in choosing a level of output that is relatively low, as accuracy will be lost. Choose a level of output around half way along the horizontal axis, and also choose a round number to make calculation easier. In this case we choose an output level of 300 (we could just have easily chosen 400, 500, or 600). We then calculate variable costs at this output level. To do this just multiply variable costs per unit by the chosen output level.
So in this case we have

£6.00 times 300 = £1800.
This is shown as point 2 on the chart

Finally we connect the two points with a straight line. We now have the variable costs line. (VC Line)

Variable Costs are:-
Wood £2.20
Glue £0.60
Packaging £1.20
Labour £2.00
Total Variable Costs per Unit £6.00





The Total Costs Line.

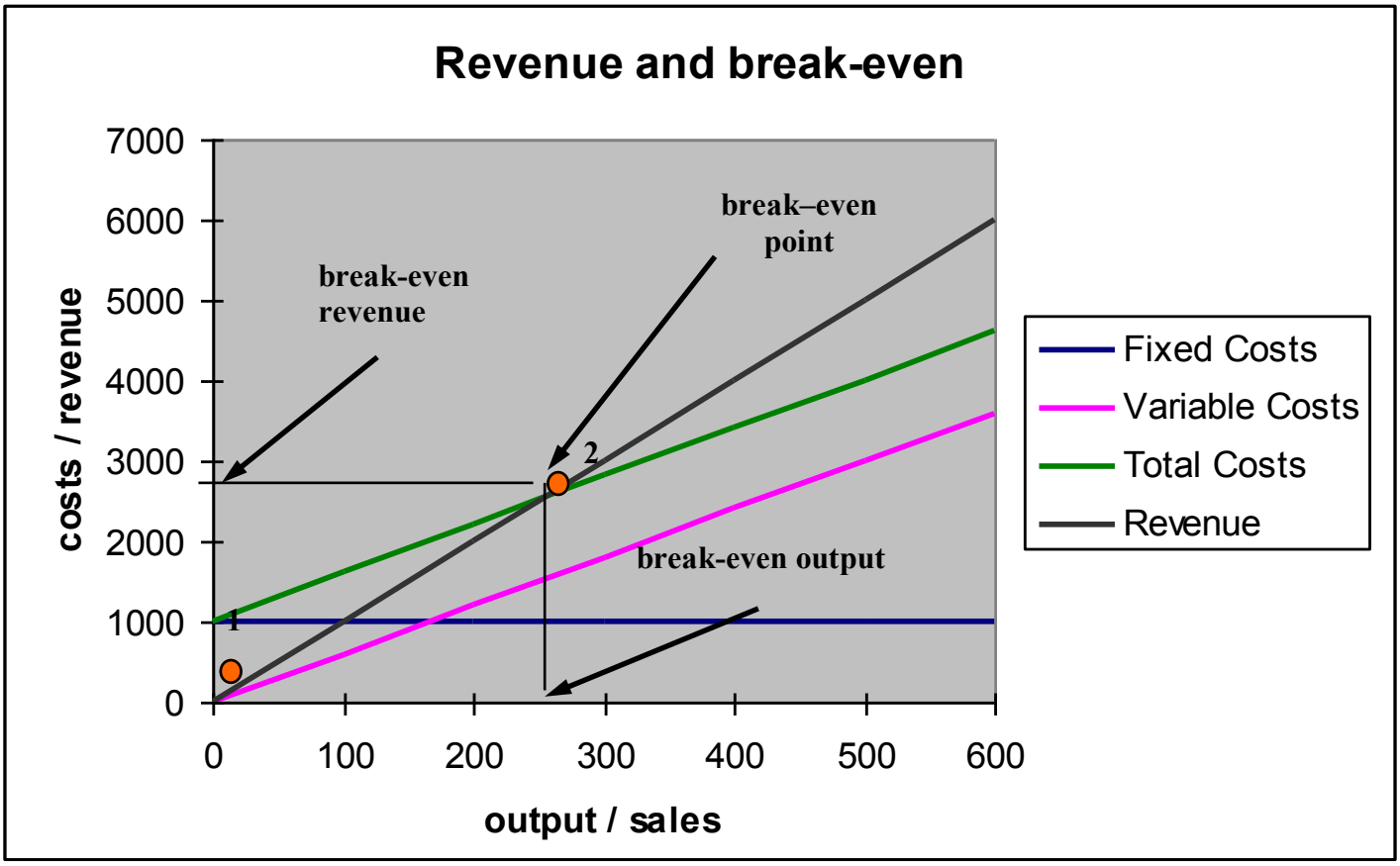
Total costs are new to us. At every level of output (apart from nil), the firms costs will be a combination of fixed and variable costs, the two added together make total costs. At output nil the firm only has fixed costs, there are no variable costs.

We must now draw the total cost line. The method is quite straightforward. We simply choose two levels of output calculate total costs at these levels and we can then draw the line. So why not make the first point chosen output nil? (point 1 above). At this point, because there are no variable costs, total costs must be the same as fixed costs.

N.B. The Total Cost Line will always start where the fixed costs line meets the vertical (costs) axis.
We can now mark the first point of our total costs line

To mark the second point, choose a level of output and add together Fixed and Variable Costs at that level. It almost always makes sense to use the same level of output as you choose when drawing the variable costs line. This is because you have already calculated the figure for Variable Costs at this output level.

In this case, at output 300 CD racks, our fixed costs are £1016 and variable costs are £1800.
So total costs at output 300 = £1016+ £1800 = £2816 (point 2 above.)



The Revenue Line.

The last line that we need to add is the revenue line. This line tells us the revenue at any level of sales. **Revenue will equal : Number of Sales times Selling Price per Unit**. In this case the sales price for CD Racks for All's product is £10. To draw the revenue line we again need 2 points. The first is straightforward. At sales nil, revenue is nil so we can mark point 1 (see below). To mark the second point we use a similar method to drawing the variable cost line. Choose a level of sales around half way along the horizontal (sales/ output) axis, and multiply this chosen level by the revenue per unit.
If we choose sales of 300 units (CD Racks) we have:-
300 (Sales) times £10.00 (revenue per unit) = £3000

So at a sales level of 300 units, then revenue is £3000 (Point 2 on the Graph).

Connect your points and you have the revenue line

The point where the revenue Line cuts the total Costs Line is break-even Point.

Draw a vertical line straight down from the break-even point, this will give you break-even output.

A horizontal line drawn from break-even point to the costs/revenue axis will give you break-even costs/ revenue.

Calculating Profit and Loss using a Break Even Chart.

Using the Break Even chart we can calculate the break even point and profit and loss at various levels of output. This method is less accurate than the first method we used (mathematical), this is because of the inaccuracies that can result from drawing and measuring the chart. Even so this method is still useful and examiners require the best possible estimate, so be careful when you are drawing your charts! Ensure your lines are straight and your pencils sharp!

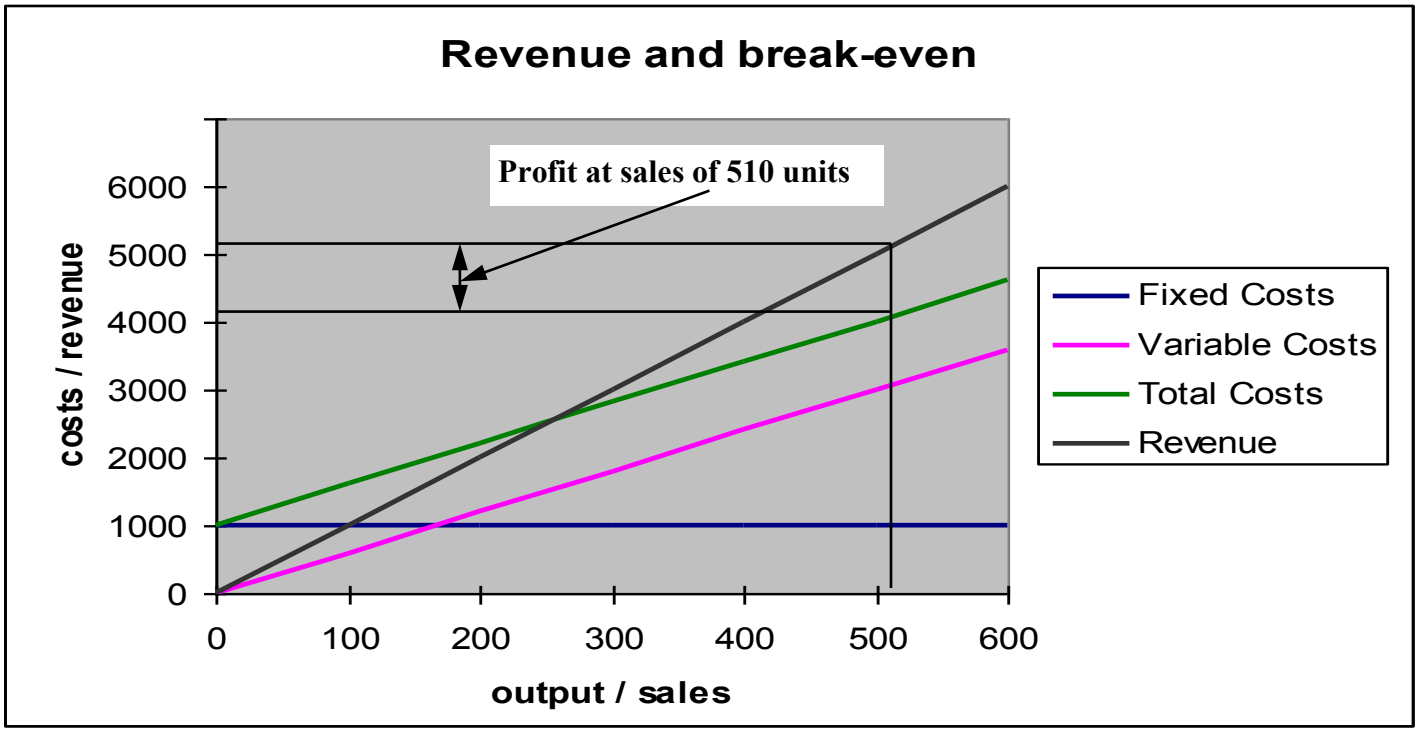
Below we see the same costs and revenue chart. In this case break even output is 280 (try checking the accuracy of this using the mathematical method).

Calculating Profit

To find profit or loss at different outputs we must measure the difference between the Revenue Line and the Total Costs line at the given level of output. In exam questions you will be given an output, for example you may be asked to calculate profit at output 510 units.

So using this figure (510 units), you would firstly draw a vertical line up from the 510 output point, you would draw this so that it meets both the total costs and revenue line, (this has been done on the chart below). At output 510 we are to the right of Break Even point, so we are making a profit. We can see this clearly because the Revenue line is above the Total Costs line at this level of output, i.e. revenue is greater than total costs at 510 sales/output, so the firm is making a profit.

To find out exactly how much profit is being made at this level of output (or any other output level), we measure the gap between the lines, (again this is shown below). I estimate this profit to be £900, but you can check the accuracy of this by redrawing the chart on graph paper.



Calculating Losses

To find a loss, carry you out the same process. Draw a vertical line from given output, try it with 150 units. In this case output will be lower than Break Even, so Total Costs will be higher than Revenue, if Total Costs are higher than Revenue the firm must be making a loss.

To calculate the loss we take Revenue at the given output from Total Costs at the same output. Remember to read the figures from the vertical axis.

Margin of Safety.
Margin of safety is the difference between output level and break-even output level. So if a firm has an output level of 600 and break-even output level is 450, the margin of safety is 150 (600-450). A high margin of safety is desirable, as even if output falls, then it is likely that profits will be made, but a low margin of safety indicates that a fall in output might quickly lead to losses being made, If margin of safety is low, then firms need to increase output through increased orders, or reduce costs and hence reduce break-even point, increasing the margin of safety.

Capacity.
It seems obvious that firms should try to produce at maximum capacity, the highest output level on the horizontal axis of the break-even chart, after all profits and return on investment will be maximised, and the margin of safety will be at the highest possible level. But there is a downside, pressure may be put on quality, there could be an increase in costs because of increase in maintenance costs, and there will be little room for manoeuvre—what if the firm received an extra order with high levels of contribution—could this order be fulfilled?

What is contribution?

Because each item produced or sold results in the firm spending money on variable costs, not all of the revenue received from selling that item can be profit. The difference between the revenue or selling price of an item, and the direct cost of producing that item is known as contribution.
This difference is known as contribution because it is the amount each item sold contributes toward paying the other costs of the business ie. the fixed costs. If a shop owner buys a tin of beans for 26p and sells it for 40p the contribution of that tin of beans is, 40p - 26p = 14p. This 14p is left over to help pay for the firms fixed costs such as rent, rates etc. Once fixed costs are covered (paid), then the contribution earned on each item sold becomes profit.
It is always worth firms examining contribution, as decisions on order acceptance and investment can be based on contribution earned.

What-if analysis.

What-if analysis basically involves asking questions of the type “What if the price we sell at changes?” and is used every day by those involved in management accounts analysis and decision making.
Other examples of questions asked might be “What will our profit be if our sales increase by 100 units per month?” or “What will our margin of safety if fixed Costs increase by 10%. The nature of break-even graphs makes them suitable for carrying out what-if analysis, (but perhaps not a suitable as spreadsheets). On a break-even graph a what-if analysis is likely to involve redrawing lines to show changes in costs or revenues, to give a new break-even point and new levels of profit and loss at different levels of output.

Notes