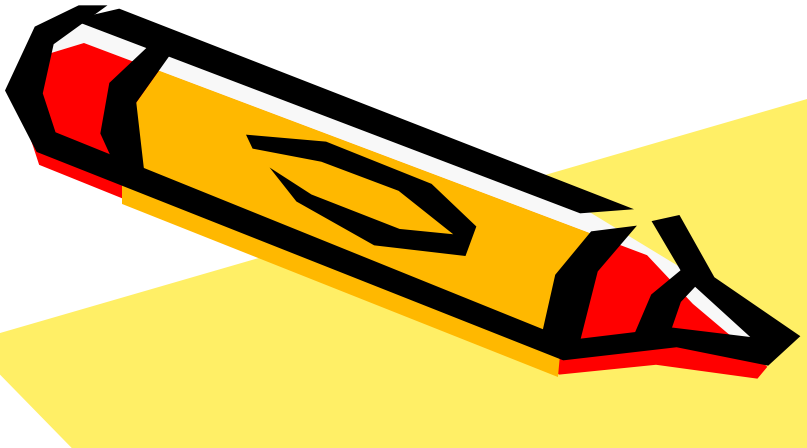
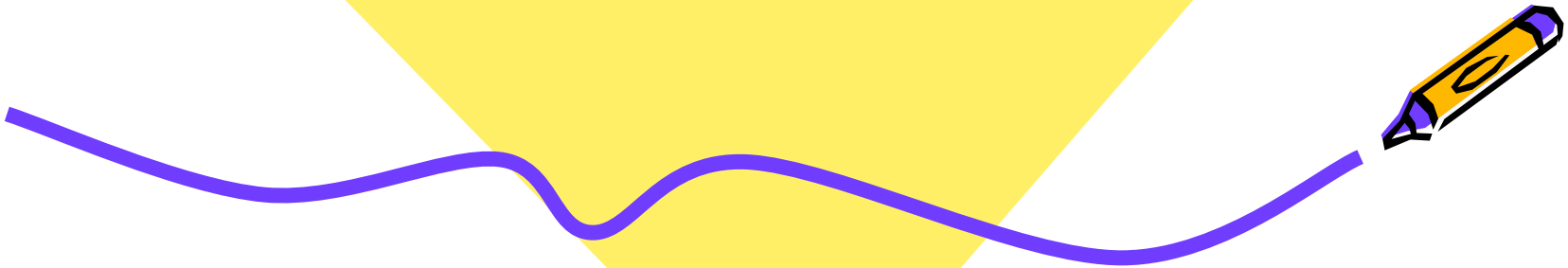


Break-even Analysis

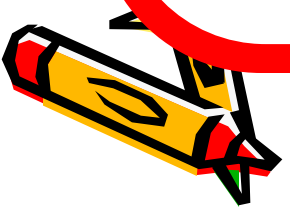


Tom can hire an ice-cream van for an afternoon at a summer fete. The van hire will be $100 and the cost of cornets, ice cream etc will $0.5 per ice cream.

Tom thinks a sensible selling price will be $ 1.50.

At this price, how many ice-creams must he sell to cover his costs?

Calculating this will help Tom to decide if the idea is worthwhile.



The basics of break-even analysis 1

- Businesses must make a profit to survive
- To make a profit, income must be higher than expenditure (or costs)

Income	£50,000
Costs	£40,000
Profit	£10,000

Income	£50,000
Costs	£60,000
Loss	£10,000

The basics of break-even analysis 2

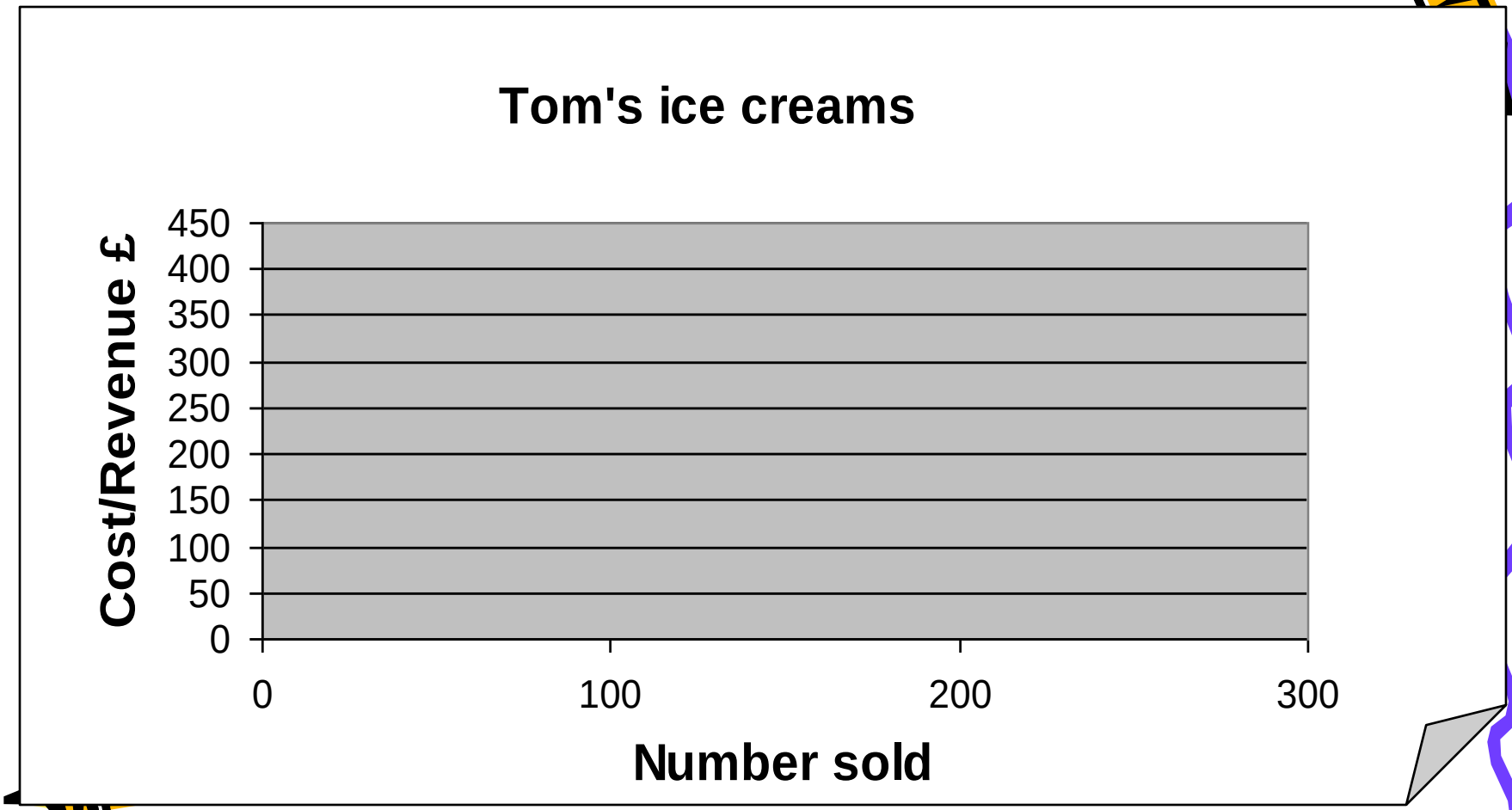
There are two types of costs:

- **Variable costs**
- **Fixed costs** (eg: rent of ice cream shop, interest on loans, insurance, staff costs (e.g. security)

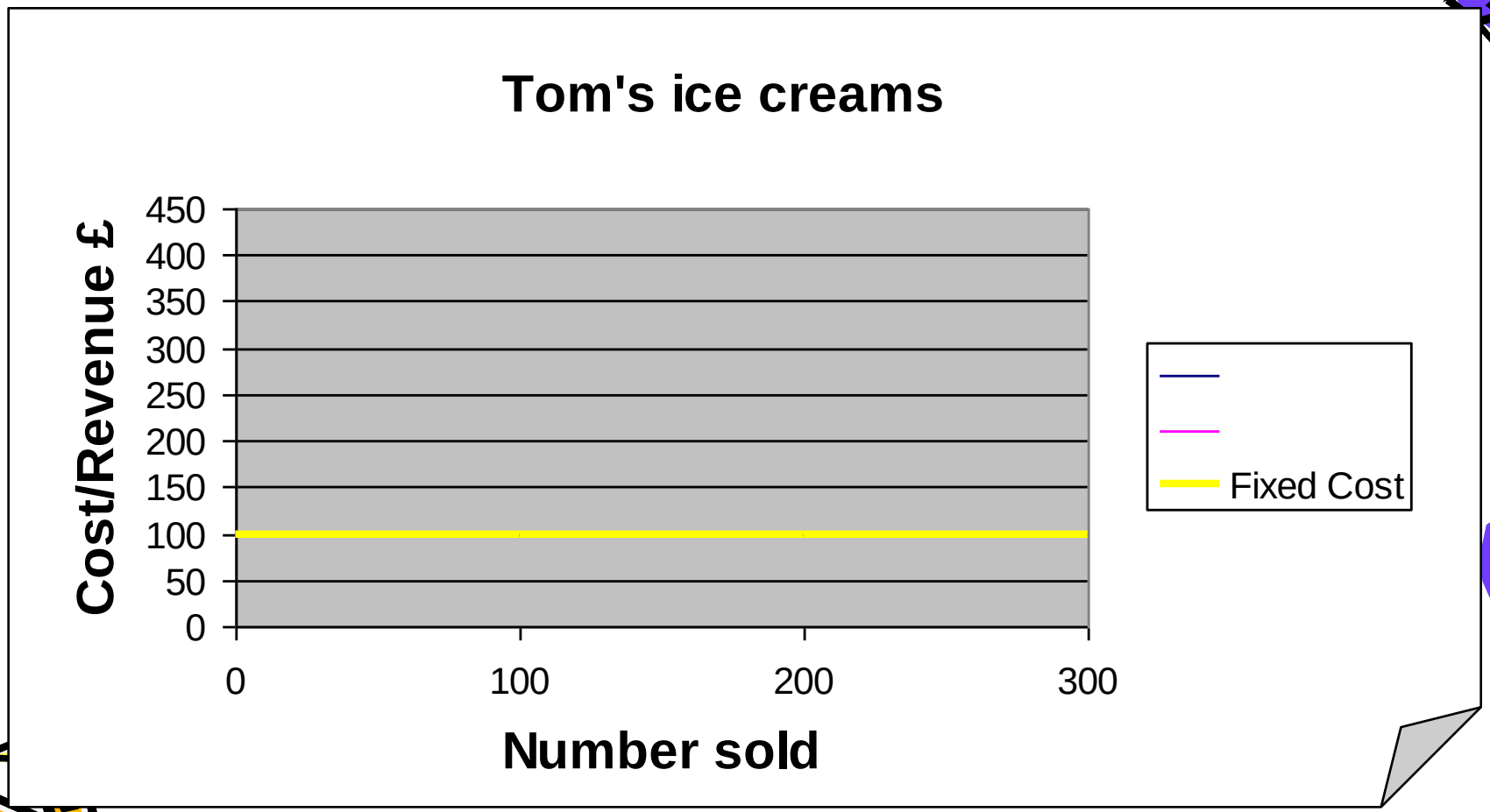
The break-even point

- Variable + fixed costs = **total costs**
- When total costs = **sales revenue**, this is called the **break-even point**, eg
  - total costs = £5,000
  - total sales revenue = £5,000
- At this point the business isn't making a profit or a loss – it is simply breaking even.

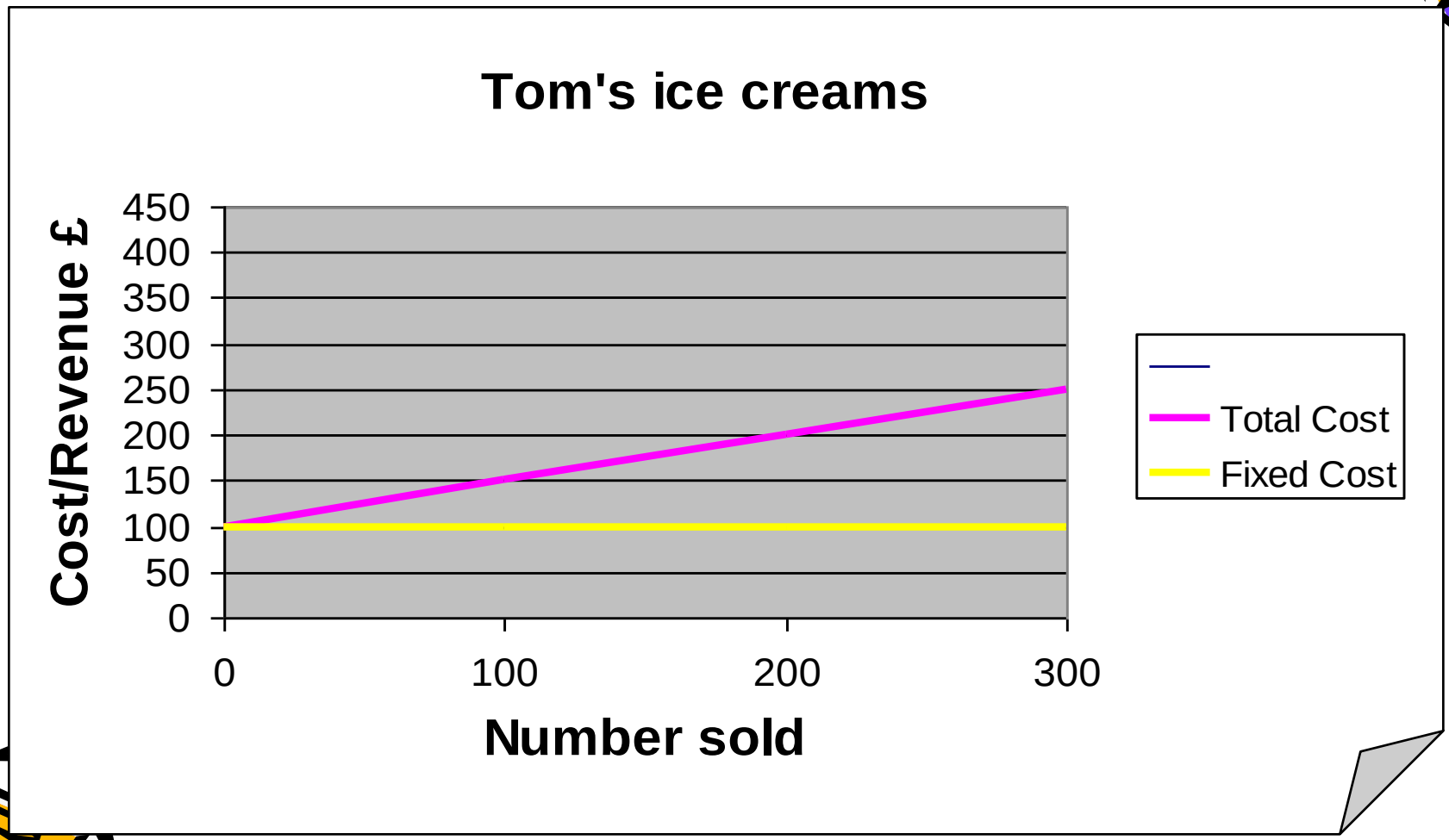
Drawing a break-even chart 1



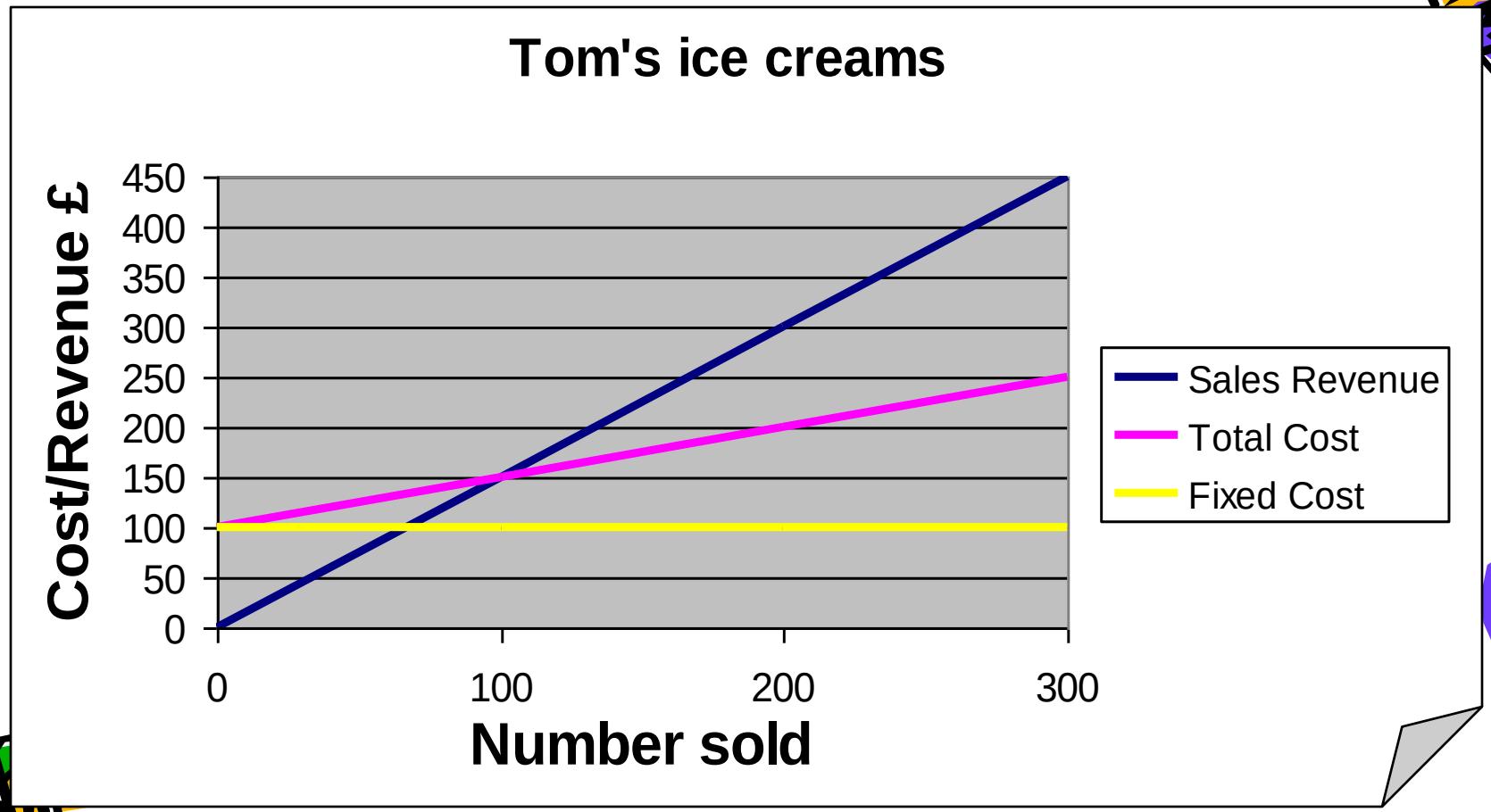
Drawing a break-even chart 2



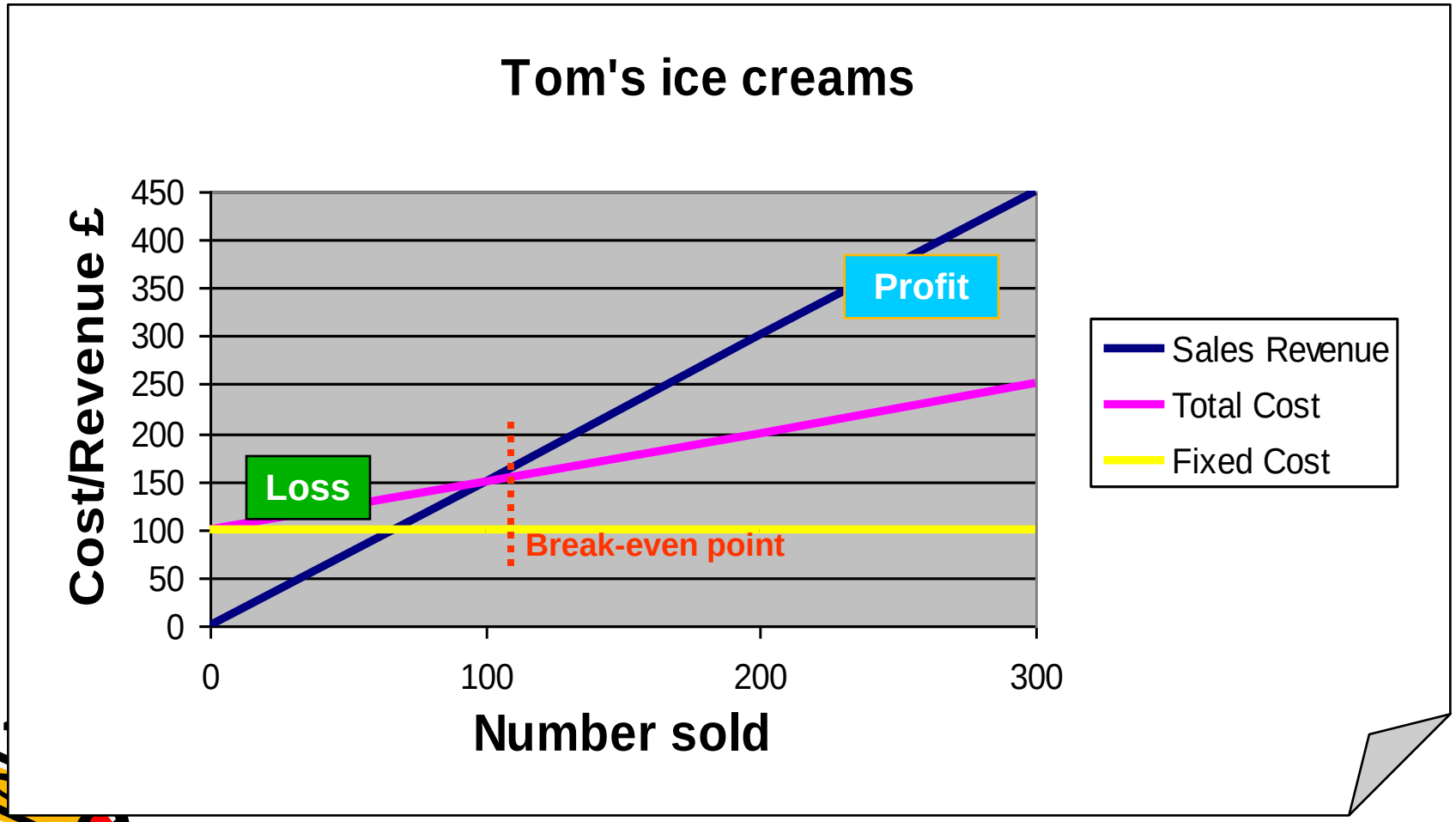
Drawing a break-even chart 3



Drawing a break-even chart 4



Identifying the break-even point



Using a formula to calculate the break-even point

The **break-even point** =

$$\frac{\text{Fixed costs}}{\text{(Selling price per unit minus variable cost per unit)}}$$

Applying the formula

$$\frac{\text{Fixed costs}}{\text{(Selling price per unit minus variable cost per unit)}}$$

Tom: $\dfrac{100}{(1.50 - .50)} = 100$

Assumptions in BE Analysis

- Costs can be classified into fixed and variable costs, thus ignoring semi variable costs.
- Selling price of the product is assumed constant.
- It assumes constant rate of increase in variable costs.
- It assumes no improvement in technology and labour efficiency.
- Production and sales are synchronized.

Uses

- It helps in determining optimum level of output below which it would incur loss.
- It helps in determining the target capacity for a firm to get the benefit of minimum unit cost of production.
- It helps in deciding which product to be produced and which to be bought by firm.
- Plant expansion or contraction decisions are often based on BEA of the perceived situation.
- Impact in changes in prices and costs on profits can also be analyzed.
- Decisions regarding dropping or adding a product.
- It evaluates financial yields, hence helps in choice between various alternatives.
- Helps in identifying the selling price of a product.

Contribution Margin

- **Contribution margin** is the marginal profit per unit sale.

- It is the difference between total revenue- total variable cost.

TCM= TR-TVC

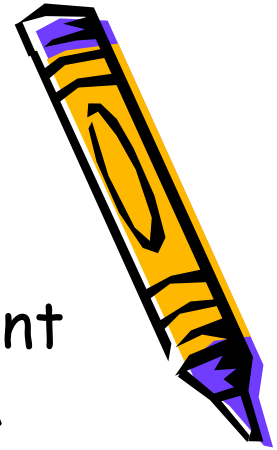
Average contribution margin= unit price- avg. variable cost

Break even occurs when, ACM= AFC

A manufacturer sells his product at Rs. 5each, variable cost are Rs. 2/unit and the fixed amount of Rs. 60000,

i. Calculate the BEP
ii. What would be the profits if firm sells 30000 units.
iii. What would be the BEP if firms spends Rs. 3000 on advertising.
iv. How much the should manufacturer sell to make profits of Rs. 30000.

Comparison of Alternatives

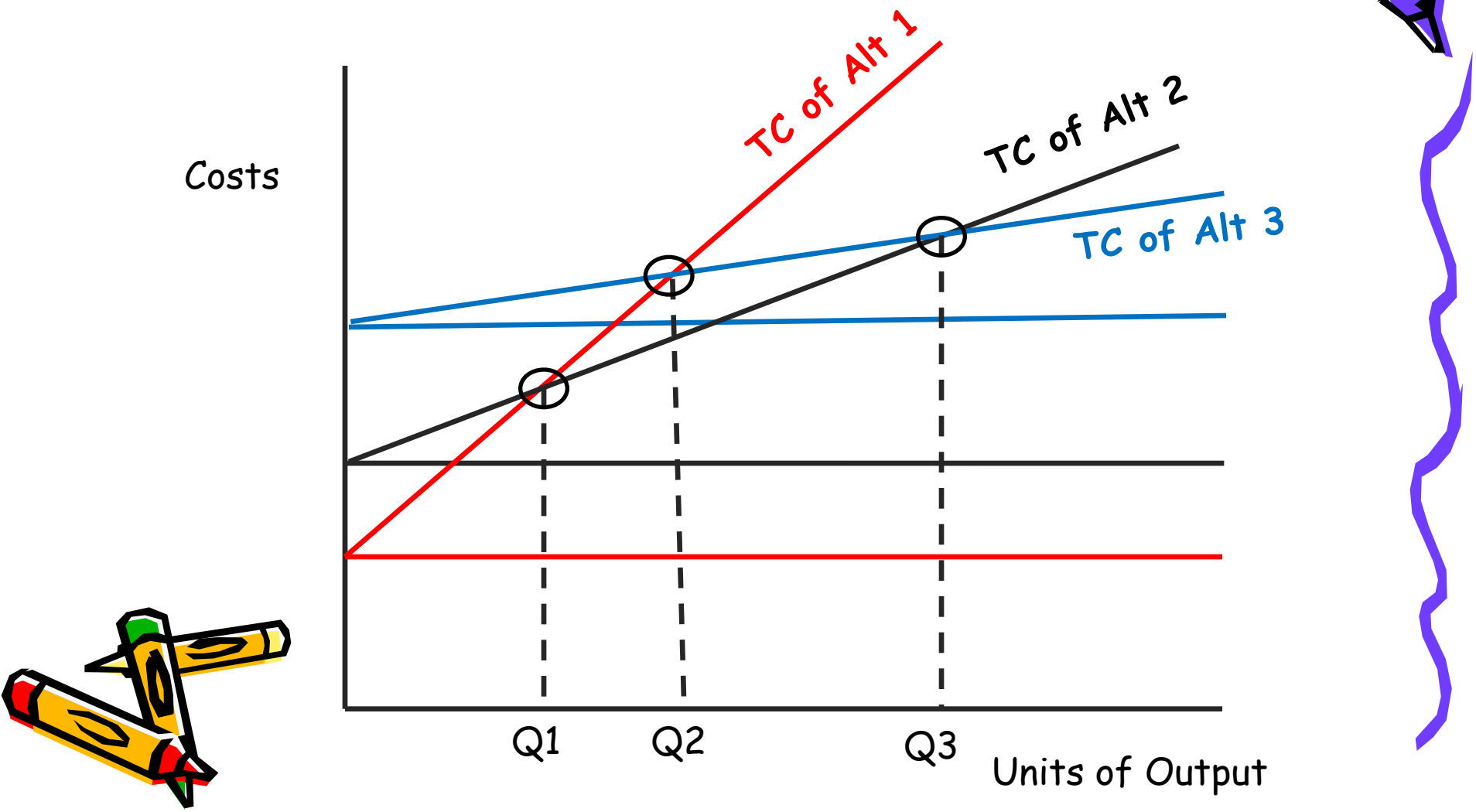


- BE analysis can be used for comparing different alternatives that are available for producing a particular product.

- These differ in terms of costs associated with them at different levels of output.

- Example at lower levels of output manual operated techniques may be profitable (because of minimum FC) and not profitable at higher outputs because of higher VC.

Thus solve with costs associated with different alternatives and determine the range of output where each alternative will be economical.



Numerical 1

A 50 HP motor is required to drive a pump to remove water from a tunnel. The unit will be needed for a period of 4 years.

Two alternatives are under consideration.

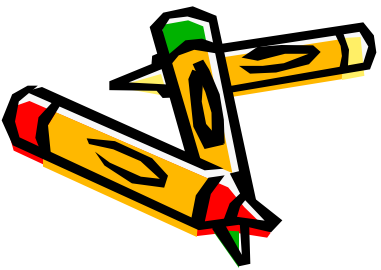
Alternative A calls for the construction of a power line and purchase of the electric motor at a total cost of $4900. The salvage value of this equipment after 4 years is estimated to be $700.

The cost of the current for the per hour of the operation is estimated to be $2.94 and the maintenance is estimated as $420 per year.

Alternative B calls for purchase of diesel engine pump set at a cost of $1925 and it will have no salvage value at the end of 4 years period. The cost of diesel per hour of operation is estimated at $1.47 maintenance is estimated at $0.53 per hour operation and the cost of wages chargeable when the engine runs is $2.8 per hour.

How many hours per year the two machines have to run so that the two alternatives incur equal costs. If the no. of hours of operation is estimated at 100 hours which alternative is more economical. Take interest rate at 10% per year.

- Let x be the no. of hours of use of the operation per year
- TC_a is total equivalent annual cost of ALT A
- TC_b is total equivalent annual cost of ALT B



- TC_a = Capital Recovery + Maintenance cost per year + Current cost per year
- $TC_a = (P-S)(A/P, I, n) + Si + 420 + 2.94x$
- $= (4900-700)(A/P,I,n) + 700*0.1 + 420 + 2.94x = 1815 + 2.94x$ ---(1)
- $TC_b = (1925-0)(A/P, 10\%, 4) + .10*0 + (1.47+0.53+2.8)*x$
- $TC_b = 607.28 + 4.8x$ ----> (2)
- Equate 1 & 2
- $607.28 + 4.8x = 1815 + 2.94x$
- X= 649 hours

- If X=100,
- TCa= $2109
- TCb=$1087.3
- B is more economical

Numerical 2

A contractor is offered his choice of either gasoline, diesel or butane engine to power a bulldozer he is to purchase.

- The gasoline engine will cost $2000 and will have a estimated maintenance cost of $200 per year and will consume $3.6 worth of fuel per hour of operations.
- The diesel engine will cost $2,800 and will cost an estimated $240 per year to maintain and will consume $3.30 worth of fuel per hour.
- The butane engine will cost $3,300 and will cost $315 per year to maintain and will consume $2.9 worth of fuel per hour of operation.

Since the salvage value of the engine is identical it can be neglected. All other costs associated with the three engines are equal and the interest rate is 15%. The service life of each engine is 5 years.

- Plot the total annual cost of each engine as a function of no. of hours of operation/year.
- Find the range of no. of hours of operation for which it would be most identical to specify the gasoline, diesel and butane engines.

- Let x be the no. of hours of operations of each engines per year
- TC1 = Total equivalent annual cost of gasoline engine
- TC2 = Total equivalent annual cost of diesel engine
- TC3 = Total equivalent annual cost of Butane engine
- TC1= 2000(A/P, 15%, 5)+ 200 +3.6x
- TC2 = 2800(A/P, 15%,5) +240+3.3x
- TC3 = 3300(A/P, 15%,5) +315+2.9x
- Comparing
- TC1 = TC2
- X= 729 hours
- TC2=TC3,
- X= 516 hours
- TC3= TC1,
- X = 719 hours