Fifth Edition

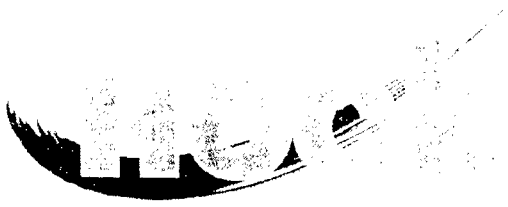
CMA

Preparatory Program

Part 2
Volume 2: Sections C – E

Financial Decision Making

Brian Hock, CMA, CIA
and
Lynn Roden, CMA
with
Dave Fairchild, CMA, CPA



HOCK *international*, LLC
P.O. Box 204
Oxford, Ohio 45056

(866) 807-HOCK or (866) 807-4625
(281) 652-5768

www.hockinternational.com
cma@hockinternational.com

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CMA Part 2

Volume 2: Sections C – E

Financial Decision Making

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Throughout these materials, we have chosen particular language, spellings, structures and grammar in order to be consistent and comprehensible for all readers. HOCK study materials are used by candidates from countries throughout the world, and for many, English is a second language. We are aware that our choices may not always adhere to "formal" standards, but our efforts are focused on making the study process easy for all of our candidates. Nonetheless, we continue to welcome your meaningful corrections and ideas for creating better materials.

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I wish you success in your studies, and if there is anything I can do to assist you, please contact me directly at brian.hock@hockinternational.com.

Sincerely,

Brian Hock, CMA, CIA

President and CEO

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Section C – Decision Analysis and Risk Management

Introduction to the Decision Analysis and Risk Management Section

The Decision Analysis and Risk Management section represents 25% of the CMA Part 2 exam. The exam is a four-hour exam that will contain 100 multiple-choice questions and 2 essay questions. Topics within an examination part and the subject areas within topics may be combined in individual questions. Therefore, we cannot predict how many multiple choice questions you may get from this section, nor can we predict whether you will get any essay questions from this section. The best approach to preparing for this exam is to know and understand the concepts well and be ready for anything.

There are basically four main parts to this section:

- Marginal analysis,
- Pricing,
- Cost-volume-profit analysis (or breakeven analysis), and
- Risk Management

In marginal analysis, you need to be able to recognize relevant revenues and costs as well as irrelevant ones in order to make a decision in a question to determine what minimum price will be charged for the product, or whether or not the company should accept the one-time order, for example. This requires a solid understanding of variable and fixed costs. While variable costs are usually relevant and fixed costs usually are not, that is not always the case.

In pricing, you must understand the different cost bases that are used to calculate the price, and you may also need to calculate the necessary price in order to achieve some specific goal of the company.

In CVP analysis you will need to be able to calculate the number of units (or the sales revenue) required to break even, and also calculate additional items, such the number of units above or below breakeven, including how many units need to be sold to achieve a certain profit level.

The Decision-Making Process

No matter what position someone has within a firm, if they are in management or in planning, their job requires decision-making. The goal of decision-making is to maximize the benefits and/or reduce the costs to the company by selecting the best option from among the available options. While on the surface this seems easy enough, determining the best option is not always easy. Many times this is because the company may have more than one objective that it is trying to meet. An option that is the best choice for one objective may not be the best option for another objective. In these situations, it is important that top management has communicated the goals of the organization so individuals know which objective is more important.

As a starting point, some of the types of decisions managers make every day are:

1) **Pricing**. Should the price be based upon our costs, or upon the market (target pricing)? Will a customer be profitable enough to justify aggressive pricing?

2) **Alternative manufacturing options.** What is the most cost-efficient and best way to manufacture the product? What is the most profitable output level? Should a one-time special order be accepted?

3) **Research and development.** What new products should we be exploring?

4) **Marketing**. What or who is our target market? What is the best way to reach that market? Is an individual customer profitable, or should that customer be dropped?

5) **Distribution.** What is the best way (or ways) to deliver the product?

6) **Contract negotiations.** What must the company attain in a negotiating situation in order to operate profitably?

7) **Outsourcing decisions**. These are essentially "make-or-buy" decisions.

8) **Capital budgeting decisions**. Should a proposed long-term project, such as a new plant or a product line, be implemented? Should an unprofitable branch be closed?

Note: Factors and information that are relevant to a decision will probably include both quantitative and qualitative items.

Qualitative factors are factors that cannot be measured in numerical terms, such as employee morale. Although qualitative factors cannot be measured numerically, they can be judged and assessed and, therefore, they may be very relevant in decision-making.

For example, if the company is going to choose to buy from outside, management must be certain that the product will be manufactured to the necessary quality standards and delivered in a timely manner. If either of these will not be met, the company would probably be better off continuing to make the product, even if this is the more expensive option. The company must also assess the social impact and the reaction of the public if they close a factory or lay off workers as a result of buying from the outside instead of producing internally.

Quantitative factors are those that can be measured in numerical terms. Some quantitative factors are financial, such as costs of direct materials, direct labor and selling costs. Other quantitative factors are nonfinancial, such as reduction in product development time or improvements in customer service.

Marginal Analysis

Relevant Information

In decision-making, one of the primary challenges is distinguishing between factors that are **relevant** to the decision and those that are **not relevant.**

Relevant revenues and relevant costs are those expected **future** revenues and costs that **differ among alternatives.** Only relevant revenues and costs need to be considered in the decision-making process. This is because:

- It is important to focus on the future since nothing can be done to change past costs that have already been incurred (called **sunk costs**). Because decisions focus on selecting future courses of action, sunk costs are **irrelevant** to the decision process.
- We must focus only on the factors that **differ among alternatives**. Revenues and costs that are the same between options are not relevant because they will be the same no matter which option is selected.

In considering what factors to include in the decision process, we must ask ourselves, "What difference will this decision make? What will be **different** as a result of making this decision versus a different decision?"

Marginal Costs and Marginal Revenues

Marginal costs and **marginal revenues** are the addition to total cost or the addition to total revenue that results from a one-unit increase in production. The terms can also be used in the context of decision analysis to refer to the addition to total cost or the addition to total revenue that would result from a project that is under consideration.

Incremental and Differential Costs

Relevant revenues and costs are further classified as **incremental revenues and costs** or **differential revenues and costs**. The terms "incremental" and "differential" are often used interchangeably; however, they are not the same. Incremental revenues and costs are **incurred additionally as a result of an activity**. Differential revenues and costs are those that **differ between two alternatives**.

As an illustration of a **differential cost**, let's say a company's existing machine has worn out and can no longer be repaired. Management has a choice: it can either replace the worn-out machine with an updated model of the same type; or it can upgrade to a fully automated, totally different system. Keeping things as they are is not an option. The company has to buy one machine or the other. So the difference in costs between the replacement machine and the upgraded machine – the differential costs – are the relevant costs in this decision. The cost of doing nothing is not relevant, because it is not an option.

On the other hand, if the old machine were not worn out, then the choice would be between keeping the old machine at its existing costs and upgrading to a new machine. The relevant costs would be the **difference** between the costs for the old machine and the costs for the upgraded machine. These costs would be **incremental costs.**

Avoidable and Unavoidable Costs

Avoidable and unavoidable costs are another classification of costs that is part of the relevant cost discussion. An **avoidable cost** is a cost that can be avoided if a particular option is selected. It is a cost that would go away. For example, if production is outsourced, the variable cost to produce the product in-house will go away and be replaced by the cost to purchase the product externally. Avoidable costs are relevant costs to the decision-making process because they will continue if one course of action is taken but they will not continue if another course of action is taken.

An **unavoidable cost** is an expenditure that will not be avoided (i.e., will not go away) regardless of which course of action is taken. Continuing the example from above, an unavoidable cost would be a payment on a noncancelable lease for production equipment that would have to continue to be paid even if production were outsourced.

Avoidable and unavoidable costs are relevant in a decision to close a plant or other business unit. If closing the unit would avoid certain costs, those avoidable costs are relevant to the decision. Unavoidable costs, however, are irrelevant because they do not differ between the two alternatives. If the fixed plant costs would continue even if the plant were closed, those fixed plant costs are unavoidable costs and they are not relevant to the decision.

A central administrative cost that has been allocated to a division is another example of an unavoidable cost, because if that division were to be closed, the cost would continue to be incurred by central administration. It would simply be allocated to another division or divisions. So for the company as a whole, it would not differ between the two alternatives of closing the division or keeping it open.

Only costs that would be avoided (i.e., costs that would go away) if the division were closed are relevant to the decision to close a division or not close it.

Sunk Cost

As mentioned above, a **sunk cost** is a cost for which the money has already been spent and cannot be recovered. Sunk costs are not relevant to decision-making because they will not be any different regardless of what decision is made.

Explicit and Implicit Costs

An **explicit cost** is a cost that can be identified and accounted for. Explicit costs represent obvious cash outflows from a business.

On the other hand, an **implicit cost** is an implied cost. It is more difficult to identify, and it does not clearly show up in the accounting records, although it is there.

Opportunity Costs

Relevant revenues and costs may include **opportunity costs**. An opportunity cost is the contribution to income that is forgone by **not using** a limited resource in its best alternative use. Opportunity costs are examples of **implicit costs**.

Opportunity costs can and should be estimated in any decision where they are a factor. For instance, in a make-or-buy decision, if the facilities to make an item could be used in the production of an alternative item, the contribution to income from the alternative item (the item that is foregone to use the facilities to make the first item) is an opportunity cost, if the first item is made.

The **relevant** portion of the opportunity cost is the **difference** between the contribution to income that could be earned on the alternative item and the contribution to income that can be earned on the item to be produced.

When calculating the opportunity cost, it is critical to keep in mind that the opportunity cost is calculated only from the **revenues that would not be received and expenditures that would not be made** for the other available alternatives. Similarly, any interest cost that is part of the opportunity cost can only be calculated for the time period when the cash flows are different between or among the options.

Note: Opportunity costs exist only if there is a constraint (limitation) on the availability of a resource. If there is no constraint, there is no opportunity cost because all of the available options are able to be selected.

For example, if a company has unused production capacity, it can accept a new order without having to stop production of other orders. But if the company is producing at capacity, to accept a new order it would need to stop production of another order or orders. Although the company would earn a contribution margin from the production of the new order, it would have to give up the contribution margin it could have earned from the other order(s) that it can't produce. The contribution margin given up is an opportunity cost that should be included in the cost of the new order in deciding whether or not to accept the new order.

Relevant Revenues

Like relevant costs, **relevant revenues** are revenues that differ between or among alternatives. In a decision about whether or not to invest in a new project, the forecasted revenues that the project would generate are relevant revenues.

Summary: Revenues and costs are **relevant** if they:

1) Occur in the **future**, and

2) **Differ** among the various alternatives available.

Question 1: American Coat Company estimates that 60,000 special zippers will be used in the manufacture of men's jackets during the next year. Reese Zipper Company has quoted a price of $.60 per zipper. American would prefer to purchase 5,000 units per month, but Reese is unable to guarantee this delivery schedule. In order to ensure availability of these zippers, American is considering the purchase of all 60,000 units at the beginning of the year. Assuming American can invest cash at 8%, the company's opportunity cost of purchasing the 60,000 units at the beginning of the year is:

a) $2,640

b) $1,320

c) $1,500

d) $1,440

(CMA Adapted)

Question 2: A printing company is considering replacing an old printing press. The old printing press has a book value of $24,000 and a trade-in value of $14,000. A new printing press would cost $85,000 after trade-in of the old press. It is estimated that the new printing press would reduce operating costs by $20,000 per year. If the company decides not to purchase the new press, the $85,000 could instead be used to retire debt that is currently costing $9,000 per year in interest. Which of the given is an example of a sunk cost?

a) The trade-in value of the old printing press.

b) The interest on the existing debt.

c) The estimated reduction in operating costs.

d) The book value of the old printing press.

(CIA Adapted)

Differences Between Economic and Accounting Concepts of Costs

One of the major distinguishing factors between accountants and economists in the way they evaluate situations depends on the concept of opportunity cost. Accountants ignore the opportunity cost because it is hard to calculate due to a lack of precise numbers and costs. The notion of opportunity cost, however, is an important part of decision making, because opportunity costs are different between alternatives just as surely as accounting costs are, and so they are relevant to the decision.

For the economists, not only the typical costs such as monetary expenditures are part of all the costs that a company or an individual incur, but the **forgone alternatives** that had to be dismissed in order to achieve that one goal should also be considered. For example, in order to make a deal a businessperson has to devote

time to prepare for the contracts and negotiations, and that is the forgone time that can no longer be used for another deal. Hence, this lost time is also part of the costs that should be considered. Similarly, a truck that is carrying aluminum cannot simultaneously (at the same time) transfer iron. Comparing how much a company is giving up if it chooses to carry aluminum instead of iron is part of the determination of the opportunity cost and economic costs in general.

Opportunity cost guides decisions on how to distribute resources the most efficient way and that is why it is important in determining economic costs. It highlights not only the monetary costs associated with each action, but the forgone time and use of resources, creating a bigger picture of the total effort that must be undertaken. It is important to understand that opportunity cost is the cost of the "**next best alternative**" or the "**next highest valued alternative.**" It is the price of not only some other alternative that should be considered, but also the highest other opportunity that is given up in order to achieve one project.

In calculating economic costs and in making decisions, both explicit and implicit costs must be used. In the accounting perspective, only explicit costs are considered.

Decision-making About Production Using Economics Concepts

The responsiveness of consumers to changes in the price of a good must be considered in the profit-maximizing decisions of a financial manager. Optimal decision-making requires information derived from **marginal analysis**.

Marginal Analysis

Marginal analysis is the process of looking at one more unit and asking, "what will be the effect of selling/producing one more unit?" There are many different marginal measures that can be used, some of which we have already discussed.

Marginal Revenue	The **addition to total revenue** gained by producing an additional unit *of output*.
Marginal Cost	The **addition to total cost** by increasing production by one unit.
Marginal Profit	Marginal revenue minus marginal cost. This is the additional profit that the company would get by producing and selling one more unit.
Marginal Product (or Marginal Physical Product)	The **additional output** that is produced from adding one additional unit of input.
Marginal Resource Cost	The **change in the total cost** that results from using one additional unit of a resource.
Marginal Revenue Product	This is the **change in total revenue** that arises from using one more unit of *a resource*.

Marginal Revenue

Marginal revenue is the additional revenue that a firm receives when it increases output and sales by one more unit. If a company is producing and selling 1,000 units per month and it increases that to 1,001 units, it will take in some additional amount of revenue each month.

In order to understand how much total revenue will increase when production increases by one unit, though, it is necessary to understand the difference in the various economic market structures, because marginal revenue behaves differently under different market structures. The market structures are covered in detail in the HOCK *Assumed Knowledge* e-book, Vol. 1, so they will be described just briefly here.

Perfect competition – In a perfectly competitive market, there are many buyers and sellers and customers are indifferent as to which seller they buy from. The product is standardized, so the same product is available from every seller. Sellers in a perfectly competitive market can sell as much of their product as they want to at the market price. If they try to charge more than the market price, they will sell nothing. If they drop their price below the market price, they can still sell as much of their product as they want to. But if they drop their price below the market price, their total revenue will be lower than it could have been, because they could have sold the same amount at the market price and earned more total revenue.

In a perfectly competitive market, the marginal revenue from the sale of one more unit is equal to the market price.

Monopoly – A natural monopoly exists when economic and technical conditions are present in the industry or economy that permit **only one efficient supplier** in a location. A common example of a natural monopoly is a municipal water company. Characteristics of a monopoly include a single supplier of a product that is unique where there are very high barriers to entry for new suppliers. A monopoly has control over the price it charges, in contrast to the perfectly competitive firm that must sell its product at the market price.

Even though the monopolist has control over the price it charges, it cannot increase prices and expect to sell the same amount of product. The monopolist faces a downward sloping demand curve, and when it increases its prices, it sells fewer units. Similarly, when it decreases its prices, it will sell more units.

The marginal revenue curve of a monopolist is below its demand curve because as production increases, a monopolist that charges the same price for all of its output will have to lower its price in order to get consumers to buy the additional output. Therefore, the additional (marginal) revenue received from producing an additional unit will be less than the price received for that unit. This idea is illustrated in the example below.

Price	Quantity Sold	Total Revenue	Marginal Revenue
$ 20	0	$ 0	
18	1	18	$18
16	2	32	14
14	3	42	10
12	4	48	6
10	5	50	2
8	6	48	(2)

Monopolistic Competition – There are many firms operating in the market, and they do not collude with one another in setting prices. The products produced by the various firms are similar but not identical. There are differences among them. The firms in the market have limited control over prices, even though there are many firms, because of the differences in the products. One firm can charge more than another one because of offering more features, and so forth.

Just as with a monopoly, firms operating under monopolistic competition have marginal revenue curves that are below the demand curve. So a firm in monopolistic competition must also drop its price in order to sell additional units, although this is mitigated somewhat by the product differentiation.

Oligopoly – In an oligopoly, there are only a few firms operating in the market. Each one is affected by what the others do. The market can be either for standardized or for differentiated products. Participants in an oligopolistic market will exhibit **strategic behavior**, meaning that each company will consider the impact of its actions on its competitors and the reaction that it expects from its competitors.

In an oligopoly, it is theorized that a **price decrease by one company will usually be matched** by others' price decreases, but a **price increase by one company will usually not be followed** by the other companies.

Thus, if one firm increases its price, it will lose volume to the other producers since they will not increase their prices and thus they will secure more volume. If the other firms did not match the lower price, a price decrease by one firm would allow that firm to capture more of the market. However, competitors tend to match a price decrease; so any increase in volume that the firm would received would not be enough to offset the lower price, and total revenue will decrease.

Given that there is a negative effect to either increasing or decreasing the price, prices in an oligopoly tend to be "sticky" (meaning that they do not change easily).

Marginal Revenue for a Firm in Monopolistic Competition

For a firm in monopolistic competition, marginal revenue typically declines as production and sales increase, because companies generally must cut their prices in order to increase their sales. Note that price cuts apply to all units sold, not just to the incremental increases in sales. For example, let's say that during a one month period, a monopolistically competitive company could set the price of its product at $420 per unit, and it could sell 4 units at that price for a total revenue of $1,680. Or, it could drop its price to $400 per unit, and it would be able to sell 5 units, for a total revenue of $2,000.

The company would not have been able to sell 4 units at $420 per unit and then drop the price and sell 1 more unit at $400 per unit, however. If it had tried to do that, the month would have been over by the time the first 4 units had been sold! So at the **beginning** of the month, the company must set the price at $400 per unit if it wants to sell 5 units, and it must sell all 5 units at that lower price. During that month, it will sell 5 units instead of 4 units. Its total revenue is $2,000 (5 × $400), and that is $320 more than the $1,680 that total revenue would have been if it had set the price at $420 per unit (4 × $420). So the marginal revenue of the additional unit is $320 ($2,000 − $1,680).

Here is the schedule of marginal revenue for this firm:

Price/ Unit	Units Sold	Total Revenue	Marginal Revenue
$480	1	$ 480	$480
460	2	920	440
440	3	1,320	400
420	4	1,680	360
400	5	2,000	320
380	6	2,280	280
360	7	2,520	240
340	8	2,720	200

Notice that the marginal revenue falls with each price decrease. Also notice that the marginal revenue on each line is lower than the price.

Marginal Cost

As total revenue increases, total cost is also increasing. The interaction of revenue and costs is what creates profits. It does no good to increase total revenue if total cost increases by more than the increase in total revenue. When that happens, profit decreases.

Remember the difference between accounting cost and economic cost. For the economists, not only the typical costs such as monetary expenditures are part of all the costs that a company or an individual incur, but the **forgone alternatives** that had to be dismissed in order to achieve that one goal should also be considered. So whenever we talk about accounting concepts such as marginal cost, average cost, and so forth, we are talking about both the explicit and the implicit, or opportunity, costs.

Marginal cost, also called **incremental cost**, is the additional cost (including opportunity cost) that results from increasing production by one more unit. As production increases, marginal cost generally decreases, up to a point. However, further production increases beyond that point lead to increasing marginal costs.

Here is a schedule of marginal costs for our firm:

Cost/ Unit	Units Produced	Total Cost	Marginal Cost
$850	1	$ 850	$850
550	2	1,100	250
430	3	1,290	190
370	4	1,480	190
360	5	1,800	320
350	6	2,100	300
355	7	2,485	385
360	8	2,880	395

Marginal Revenue and Marginal Cost

Output should be planned so that the **Marginal Revenue = Marginal Cost**. This is the point of production and sales that will maximize profit. Sales beyond this point produce a loss on each additional (marginal) item and will decrease the total profit of the firm. For a firm in monopolistic competition, the marginal revenue from selling another unit declines as volume increases. The marginal cost of production declines up to a point as production increases, and beyond that point, it tends to increase.

A firm should expand production so long as the marginal revenue from selling another unit exceeds the marginal cost, since selling this additional unit this will cause total profit to increase. Production should stop at the point where marginal revenue equals marginal cost, because if it expands beyond this point, the increasing marginal cost of production will rise above the marginal revenue, and profit will decline.

Profit

Now, let's put the two charts together and calculate the profit at each level of production and sales.

Price/ Unit	Cost/ Unit	Units Produced and Sold	Total Revenue	Marginal Revenue	Total Cost	Marginal Cost	Profit
$480	$850	1	$ 480	$480	$850	$850	$(370)
460	550	2	920	440	1,100	250	(180)
440	430	3	1,320	400	1,290	190	30
420	370	4	1,680	360	1,480	190	200
400	360	5	2,000	**320**	1,800	**320**	200
380	350	6	2,280	280	2,100	300	180
360	355	7	2,520	240	2,485	385	35
340	360	8	2,720	200	2,880	395	(160)

The highest profit is at the level of 5 units. That is also the point where marginal revenue is equal to marginal cost: the point where both are $320.

At the point where 6 units are produced and sold, profit begins to drop. Therefore, it would not be profitable for this firm, under its current cost structure, to produce more than 5 units per month.

Average Cost

Average cost per unit is the total cost divided by the total units produced. Here is a schedule for our firm of its average costs at each volume level. As you can see, average cost is also equal to the cost per unit at each level of production.

Cost/ Unit	Units Produced	Total Cost	Average Total Cost
$850	1	$ 850	$850
550	2	1,100	550
430	3	1,290	430
370	4	1,480	370
360	5	1,800	360
350	6	2,100	350
355	7	2,485	355
360	8	2,880	360

Average total cost can be split into **average fixed cost**, which is total fixed cost divided by the total units produced, and **average variable cost**, which is total variable cost divided by the total units produced.

Average variable cost rises or falls as production increases, but average fixed cost declines continuously as production increases, because the total fixed cost is being divided by an ever-increasing level of production.

Here is our firm's cost schedule again, this time divided between fixed and variable costs:

Total Cost/ Unit	Units Produced	Total Cost	Fixed Cost	Variable Cost	Average Fixed Cost	Average Variable Cost
$850	1	$ 850	$630	$ 220	$630	220
550	2	1,100	630	470	315	235
430	3	1,290	630	660	210	220
370	4	1,480	630	850	213	213
360	5	1,800	630	1,170	126	234
350	6	2,100	630	1,470	105	245
355	7	2,485	630	1,855	90	265
360	8	2,880	630	2,250	79	281

Costs and Cost Objects

Many costs that the management accountant works with are not recorded in the accounting system. Future costs, replacement costs, incremental costs and opportunity costs are all involved in decision-making but are not recorded in the accounting system.

Though all expenses (items recognized in the accounting records) are costs, not all costs are expenses. A cost could be an expense, or it could represent an asset – for example, inventory purchased. A building might cost $1,000,000 to purchase (the cost is an asset in this case), or it might cost $100,000 a year to rent (the cost is an expense in this case). In this section, we are interested more in the cost object than in whether it is accounted for as an asset or as an expense.

A **cost object is any item or activity for which we can** measure the costs. It answers the question, **"The cost of what?"**

In both of the situations mentioned above in respect to the building, the **cost object is the building.**

Examples of **cost objects**:

- A product
- A batch of like units
- A customer order
- A contract
- A product line
- A process
- A department
- A division
- A project
- A strategic goal

The proper identification of the **cost object** is important because it affects any cost measurement that is undertaken. For instance, whether a cost is considered to be a **direct cost** or an **indirect cost** depends on the cost object. If the cost object is the company's Montvale, New Jersey plant, the plant manager's salary is a direct cost, because it can be **traced** directly to that cost object. However, if the cost object is one of the products manufactured in the Montvale, New Jersey plant, the plant manager's salary is an **indirect cost**, because it is not **traceable** directly to any one product but is **allocated** among all the products produced. Allocation is the assignment of indirect costs to a particular cost object.

Cost assignment is the general term that refers to both (1) **tracing** costs to a cost object, and (2) **allocating** costs to a cost object. We will look at each of these terms in more detail.

Tracing and Allocating Costs

Cost tracing means assigning **direct costs** to a particular cost object. Direct costs (also called traceable costs) are costs that are **incurred specifically because of the cost object**. If it were not for the cost object, the direct cost would not have been incurred.

Traceable costs may be **raw materials** that can be identified as part of a finished product. **Direct labor** required to convert the raw materials into a finished product can also be directly traced to the product.

The traceability of other costs is less clear. For example, should the cost of defective units be included in the cost of good units? Whether they should be, and if so how much, depends on how management wants to use the information. Setup costs can be identified with a batch; so if the **batch** is defined as the cost object, setup costs can be considered directly traceable. However, if the cost object is an individual unit produced, setup costs can only be allocated to each individual unit.

Cost allocation is the process of assigning costs **other than direct costs** to cost objects according to some predetermined formula or allocation base.

The accurate and proper tracing and allocation of costs is important because without it, the cost of producing each item will be calculated incorrectly. If the cost is calculated incorrectly, the company may not be able to price its product properly and will run the risk of either pricing it too low, thereby losing money on each sale, or too high and not selling enough units.

Other Factors in Cost Classifications

Whether a particular cost will be classified as direct or indirect depends on several factors. Among these are:

- **Materiality.** It must be economically feasible to trace a cost to a particular cost object. Therefore, the greater the amount of the cost, the more likely it is to be traced as a direct cost to a cost object.
- **Available technology.** Technology can make it economically feasible to trace costs that at one time would have been considered indirect. For example, bar codes on component parts can be scanned at each point in the production process, thereby tracing the parts and their costs to the end product.
- **Organizational design.** It is easier to classify a cost as a direct cost if the company is organized in such a way that a given facility is used exclusively for a specific cost object such as a specific product.
- **Contractual arrangements.** A production contract may specify a specific component for use in a product, which makes it easier to classify that component as a direct cost of that product.

Cost Behavior Patterns

There are two main types of cost behavior patterns:

1) **Variable Costs** change **in total** in proportion to changes in the level of activity. A variable cost is **constant on a per-unit basis**. For example, a cost of $6 per unit is a variable cost. Direct materials are a variable cost.

2) **Fixed Costs** do not change in total as long as the volume remains within a designated range, known as the **relevant range**. This means that, within the relevant range, the cost **per unit** changes as the volume changes, but the total remains the same. For example, a cost of $100,000 for a volume of between 50,000 and 80,000 means that the per-unit cost will be $2 per unit at a volume of 50,000 and only $1.25 per unit at a volume of 80,000.

Furthermore, some costs may be either fixed or variable, depending on the circumstances. What is a variable cost under one circumstance may be a fixed cost under other circumstances. For example, direct labor will ordinarily be a variable cost. However, in some instances it could be a fixed cost if, for instance, a labor contract prohibits layoffs. It is important to review all relevant information before deciding whether a cost is fixed or variable.

Mixed Costs

In reality, many costs are a combination of fixed and variable elements. These are **mixed costs**. Mixed costs may be **semi-variable** costs or **semi-fixed** costs.

A **semi-variable cost** has both a fixed component and a variable component. There is a basic fixed amount that must be paid regardless of activity, even if there is no activity. And added to that fixed amount is an amount which varies with activity. Utilities are an example. Some basic utility expenses are required just to maintain a factory building, even if no production is taking place. Electric service, water service, and other utilities usually must be continued. So that basic amount is the fixed component of utilities. If production begins (or resumes), the cost for utilities increases by a variable amount, depending upon the production level. But the fixed amount does not change. Another example of a semi-variable cost is a salesperson who receives a base salary plus a commission for each sale made. The base salary is the fixed component of the salesperson's salary, and the commission is the variable component.

A **semi-fixed cost**, also called a **step cost,** is fixed over a given, small range of activity, and above that level of activity, the cost suddenly jumps. It stays fixed again for a while at the higher range of activity, and when the activity moves out of that range, it jumps again. A semi-fixed cost moves upward in a step fashion, staying at a certain level over a small range and then moving to the next level quickly. All fixed costs behave this way, and a wholly fixed cost is also fixed only as long as activity remains within the relevant range. However, a semi-fixed cost is fixed over a smaller range than the relevant range of a wholly fixed cost. An example of a semi-fixed cost is the nursing staff in a hospital. If the hospital needs one nurse for every 25 patients, then each time the patient load increases by 25 patients, one additional nurse will be hired and total nursing salaries will jump by the additional nurse's salary. That is in contrast to administrative staff salaries at the same hospital, which might remain fixed until the patient load increases by 250 patients, at which point an additional admitting clerk would be needed. The administrative staff salaries are wholly fixed costs (over the relevant range), whereas the nursing staff salaries are semi-fixed costs.

The difference between a semi-variable and a semi-fixed cost is that the semi-variable cost starts out at a given base level and moves upward smoothly from there as activity increases. A semi-fixed cost moves upward in steps.

Cost Drivers

A cost driver is a characteristic of an activity that affects costs, such as a given level of activity or volume over a given time span. A change in the level of activity or volume affects the level of that cost object's total costs.

For a variable cost, the cost driver is the level of activity or volume. A fixed cost has no cost driver in the short run, because fixed costs are fixed over the relevant range. However, **in the long run, all costs are variable costs**. This is the case because once the time period for which a cost is fixed (for example, a 10-year lease agreement will cause rent to be fixed cost) is over, the cost can again be looked at and may become variable. This means that over the long run, the cost driver for a fixed cost is also the level of activity or volume.

Other Cost Terms

An **imputed cost** is one that does not show up in the accounting records and is not a cash outlay, but it represents a cost that must be considered in decision-making. An opportunity cost is a type of imputed cost. For example, if a business uses space in its own production activities that it could have rented out to a tenant, the rent that it could have received and did not receive is an imputed cost.

A **postponable cost** is a cost that may be delayed to a future period with very little, if any, effect on the current operations and efficiency of the company. (Example: Training costs may be, and commonly are, delayed during a difficult financial period because training has a long-term rather than a short-term impact.)

Whether these items are relevant or not will depend on the different options available.

Income Tax Effects in Decision Making

In any analysis including incremental or differential revenues or costs, the tax effects must be included in the analysis. A net incremental revenue should be reduced by the resulting tax liability. A net incremental expense is also reduced by the tax benefit that results from the tax deductible expense. Differences in depreciation expense between one alternative and another alternative, if not included with other expenses, should be used to calculate the depreciation tax shield.

Depreciation expense is a tax-deductible expense. The amount of tax savings that results is called a depreciation tax shield. It is usually calculated as the amount of the depreciation multiplied by the company's tax rate. The amount of change in tax-deductible depreciation will cause an equivalent change (either an increase or a reduction) in the company's taxable income. That will, in turn, cause a change in the amount of tax that will be due and a change in the depreciation tax shield. The depreciation tax shield will be covered in more detail in the section on Capital Budgeting in this textbook.

Marginal Analysis Applications

Marginal analysis is the process of making a decision between or among two or more alternatives. A company makes these decisions based upon which opportunities will provide the most benefit to the company. As we have already covered, in this process of making the decision, a company must focus only on the incremental or differential revenues and costs of the projects, rather than the total revenues and costs. This is because these are the only **relevant** revenues and costs for the company.

The types of situations in which marginal analysis may be used are:

- **Make-or-buy decisions** (insourcing versus outsourcing products and services),
- **Accepting or rejecting a one-time special order**,
- Introduction of a **new product** or a change in output levels of existing products,
- **Adding or dropping product lines** or divisions, and
- **Selling or processing further** decisions.

Note: In marginal analysis, **total costs per unit are irrelevant** because they include some costs that are not incremental, such as fixed overhead costs or other costs that are common to both alternatives. Generally, it is the variable costs per unit that are relevant, but in some cases not all variable costs are relevant if they will be the same between the alternative options.

Make-or-Buy Decisions

Make-or-buy decisions are often framed in the context of whether the company should produce something itself or buy it from outside. In these decisions, as with all other decisions, the only costs that need to be considered are the **relevant costs**. These relevant costs are the costs that are different between the two options and usually consist of the **variable costs and avoidable fixed costs**. Fixed costs that will simply be transferred to another department – as allocated costs would be – are not avoidable, because the company as a whole will still incur those costs in total. These unavoidable costs are therefore irrelevant to the decision making process.

Sunk costs are also ignored. Because they are historical costs that cannot be changed, they will be the same for every option that the company has.

Management must compare the relevant costs for each option (the costs that would be incurred only if this option is chosen), and then choose the option with the lowest incremental costs. If the cost to purchase the product from outside is lower than the **avoidable** costs of producing the item internally, the company should buy the product from the outside supplier.

Note: It is possible that a problem will state that some of the variable costs are not avoidable, meaning that they will still be incurred, even if the product is purchased. Thus, these costs should **not** be treated as relevant costs as they are unavoidable.

When determining relevant costs for such types of decisions, the following must be kept in mind:

- The purchasing costs (purchase price, ordering costs, transportation costs, carrying costs, etc.) relating to the purchase from an outsider are all relevant variable costs and must be included in the cost of purchasing the item.
- Only **avoidable** fixed and variable costs of in-house production are relevant and need to be included in the cost of producing the item internally.

In a problem on the exam, you must be able to determine the **maximum price** that the company will be willing to pay an outside supplier for a product that they currently make. This price is the **amount of internal production costs that will not be incurred (i.e., that will be avoided) by purchasing the product from outside.**

Usually, the **maximum price** that a company would be willing to pay for purchasing outside the company is:

Maximum Price to Pay = Total Internal Production Costs – Unavoidable Costs (Fixed and Variable)

What we have looked at so far are the quantitative factors in the decision. However, other qualitative considerations are also potentially very important to the decision. Factors such as quality, reliability of delivery, service, flexibility in delivery terms and even possibly public relations with the community in which the factory is located may all be important factors in the decision. Unfortunately, even though these are very important factors, it is often very difficult to give a monetary value to them.

For example, if the quality of the product that is purchased from another company is not up to the standards of the company, what will be the lost profit in the future resulting from a poorer quality product? Or, what will the impact be of the company closing a facility because it has outsourced its production to another region of the country or to another country?

Example: Paterno Co. produces football goal posts for sale to college and professional football teams. The variable and fixed costs to produce a goal post are as follows:

Direct Materials	$200 per goal post
Direct Labor	$150 per goal post
Indirect Variable Costs	$75 per goal past
Fixed Costs	$125 per goal post
Selling and Administrative	$100 per goal post
Total	**$650 per goal post**

Bowden Corp. has recently approached Paterno with an offer to supply Paterno with finished goal posts that Paterno would then resell under the Paterno name. The price of one goal post from Bowden is $490.

If Paterno purchased goal posts from Bowden, all of its fixed costs would continue to be incurred, but Paterno would be able to eliminate half of the selling and administrative costs that are associated with the production and sale of their own goal posts. The other variable costs would not be incurred because they would not need to pay any production costs if they purchase goal posts from an outside supplier.

The two questions that we need to look at are whether or not Paterno should accept the offer, and if not, what is the maximum price they would pay to Bowden.

Should Paterno accept Bowden's offer, and if not, at what price would Paterno be willing to accept the offer?

Paterno should not accept the offer from Bowden. If they accept the offer, their total costs incurred would be $665 per goal post.

Goal Post itself	$490
Fixed Costs	125
Selling and Admin Costs	50
Total Purchase Price	$665

What is the maximum price Paterno would be willing to pay Bowden?

Given that Paterno will have $175 of costs that will continue even if they purchase from Bowden, the maximum price that they would be willing to pay is $175 less than their cost of production, or $475.

Other Considerations

Even if Bowden's offer had been acceptable from a quantitative standpoint, Paterno would need to determine if it is acceptable from a qualitative standpoint. Paterno is going to put its own name on these goalposts and therefore, before accepting any offer to let another company do the manufacturing, they would need to evaluate other things such as the quality of Bowden's manufacturing processes, reliability of delivery, and availability of service if necessary.

The following information is for the next two Questions: Leland Manufacturing uses 10 units of Part Number KJ37 each month in the production of radar equipment. The unit cost to manufacture 1 unit of KJ37 is presented below.

Direct materials	$ 1,000
Materials handling (20% of direct material cost)	200
Direct labor	8,000
Manufacturing overhead (150% of direct labor)	12,000
Total manufacturing cost	$21,200

Material handling represents the direct variable costs of the Receiving Department that are applied to direct materials and purchased components on the basis of their cost. This is a separate charge additional to manufacturing overhead. Leland's annual manufacturing overhead budget is one-third variable and two-thirds fixed. Scott Supply, one of Leland's reliable vendors, has offered to supply Part Number KJ37 at a unit price of $15,000.

Question 3: If Leland purchases the KJ37 units from Scott, the capacity Leland used to manufacture these parts would be idle. Should Leland decide to purchase the parts from Scott, the unit cost of KJ37 would:

a) Decrease by $6,200.

b) Increase by $4,800.

c) Decrease by $3,200.

d) Change by some amount other than those given.

Question 4: Assume Leland Manufacturing is able to rent all idle capacity for $25,000 per month. If Leland decides to purchase the 10 units from Scott Supply, Leland's monthly cost for KJ37 would:

a) Increase $23,000.

b) Decrease $7,000.

c) Change by some amount other than those given.

d) Increase $48,000.

(CMA Adapted)

Question 5: Listed below are a company's unit costs to manufacture and market a particular product.

Manufacturing costs		Marketing Costs	
Direct materials	$2.00	Variable	$2.50
Direct labor	2.40	Fixed	$1.50
Variable indirect	1.60		
Fixed indirect	1.00		

The company must decide to continue making the product or buy it from an outside supplier. The supplier has offered to make the product at the same level of quality that the company can make it. Fixed marketing costs would be unaffected, but variable marketing costs would be reduced by 30% if the company were to accept the proposal. What is the maximum amount per unit that the company can pay the supplier without decreasing operating income?

a) $7.75

b) $8.50

c) $6.75

d) $5.25

(CMA Adapted)

Special Order Decisions

In a special order situation, a company has approached our company with a request for a special, one-time order and we must determine the minimum price that we will charge. In the determination of this minimum price, there are two things that must be taken into account. These are the direct costs of production and the level of capacity at which the company is operating.

Direct (or Avoidable) Costs of Production

The minimum price charged must include all of the costs that will be incurred directly as a result of this specific order. These would be the costs that would be avoidable if the company did not produce this order. Generally, this includes the variable costs of production - direct materials, direct labor and variable overheads. Nonmanufacturing costs and fixed manufacturing costs will usually continue, even if this order is not produced.

> Note: Variable overhead is usually considered to be an avoidable cost for special orders as well as for make-or-buy decisions.

Level of Operating Capacity

The minimum price will also be affected by the percentage of capacity at which the company is operating. The issue is that if the company is operating at full capacity, in order to produce the units for this order, they will need to **not** produce some other order that they could have produced and sold instead. Therefore, if they choose to make this special order, they will need to recover not only the direct costs of producing this order but also the contribution that is lost on the units that they are not going to be able to produce and sell because of producing this order.

> Note: **Contribution** is the difference between the selling price and the variable costs associated with the unit. This is looked at in much more detail in CVP Analysis.

Operating at Less than Full Capacity

If the company is operating at less than full capacity and there is sufficient capacity to produce this new order, then the answer to the pricing question is fairly straightforward. **Only the avoidable (direct) costs of production** are used in determining the minimum price to be charged for the order. If the company can sell the product for $.01 more than this avoidable cost of production, then from a purely financial standpoint, it should accept the order.

Note: If the company is able to charge $.01 more for an order when they have excess capacity, they will be better off from a financial standpoint. Even so, they might not accept the order because of qualitative considerations. For example, existing customers may find out about the deeply discounted sale to someone else. This could place a tremendous strain on the relationship with the existing clients and may lead some to find a new supplier.

Operating at Full Capacity

In a situation where the company is operating at full capacity, it must also include the opportunity cost of producing this order as a cost to be charged to the new order.

Because the company is producing at full capacity, it is going to have to **not** produce something else in order to produce this special order. As a result, it will lose the contribution that would have been associated with the other sale, and that contribution needs to be covered in the special order. Therefore, when operating at full capacity, the company needs to make sure that it recovers not only the direct (avoidable) costs of producing this order, but also the contribution that is lost from the products that are not going to be sold as a result of accepting this order.

Scenario: Cowher Co. produces two products – refrigerators and microwave ovens. Cowher has the following information in respect to each unit produced of each product:

	Refrigerator	Microwave
Units produced	500	500
Sales price	$ 300	$ 200
Variable costs	(100)	(75)
Contribution per unit	200	125
Fixed costs per unit	(75)	(50)
Profit per unit	$ 125	$ 75

All of the variable costs will be avoided if a unit is not produced and all of the fixed costs will continue if a unit is not produced as the fixed costs will simply be allocated to the other units that are produced.

Example 1: Assume that a one-time customer comes to Cowher and offers to buy 200 refrigerators if Cowher is able to provide the refrigerators at a lower price than other companies. At this time, Cowher is operating at 60% capacity and has the ability to produce these refrigerators and all of what is currently being produced. The minimum price that Cowher should charge for the 200 refrigerators is $101. This is the amount of the variable costs that will be incurred to produce this order, plus $1. If the price were only $100, then Cowher would be indifferent to producing the refrigerators because there would be no additional contribution from them.

Example 2: Assume that a one-time customer comes to Cowher and offers to buy 200 refrigerators if Cowher is able to provide the refrigerators at a lower price than other companies. At this time, Cowher is operating at 100% capacity and in order to produce these 200 refrigerators they would need to not produce 300 microwaves. In this case, the minimum price that Cowher must charge will include not only the variable costs of production, but also the contribution that will be lost by not producing the 300 microwaves. We already know that the variable costs are $100, so we will need to look at the lost contribution. The contribution per microwave is $125 per unit and since there are 300 microwaves that will not be produced, the lost contribution is $37,500. This is the amount of contribution that the 200 refrigerators will need to provide. Dividing this amount among the 200 refrigerators, we get an amount of $187.50 per refrigerator, bringing the total 'cost' to $287.50. This means that Cowher will need to charge at least $288 per refrigerator in order to accept this order.

We can prove it this way. Currently, Cowher has $162,500 of total contribution. If they were to set the price at $287.50 for the new refrigerator order, their contribution would still be exactly $162,500. It is calculated as follows:

Original refrigerators	500 units × $200 =	$100,000
Remaining microwaves	200 units × $125 =	25,000
New refrigerator order	200 units × $187.50 =	37,500
Total contribution		$162,500

If they were to sell the refrigerators for less than $287.50, their total contribution would be less than it currently is.

Question 6: Power Systems Co. manufactures jet engines for the United States armed forces on a cost-plus basis (meaning the price will be the cost of production plus some amount or %). The cost of a particular jet engine the company manufactures is shown as follows.

Direct materials	$200,000
Direct labor	150,000
Overhead:	
Supervisor's salary	20,000
Fringe benefits on direct labor	15,000
Depreciation	12,000
Rent	11,000
Total cost	$408,000

If production of this engine were discontinued, the production capacity would be idle, and the supervisor would be laid off. When asked to bid on the next contract for this engine, the minimum unit price that Power Systems should bid is:

a) $385,000

b) $365,000

c) $397,000

d) $408,000

(CMA Adapted)

The following information is for the next two Questions: KCollins Corp. produces equipment that is sold to cities for use in parks and playgrounds for children. One of their products is backstops for baseball fields. KCollins Corp. received a first-time, one-time request for 500 backstops from the city of Cincinnati.

The selling price and the costs associated with the backstops are below.

Selling price		$ 250
Costs:		
Direct materials	90	
Direct labor	25	
Variable manufacturing overhead	18	
Fixed manufacturing overhead	30	
Variable selling costs	4	
Fixed selling costs	15	(182)
Operating profit		$ 68

Question 7: Currently KCollins has sufficient capacity to produce this order without having to reduce production of any other items. The minimum price per backstop that KCollins would charge Cincinnati for this order is:

a) $68

b) $133

c) $137

d) $182

Question 8: Currently KCollins is operating at 100% capacity and in order to produce this order for Cincinnati they would need to stop production of another product completely. This other product provides $15,000 of contribution to KCollins. Under these circumstances, the minimum amount that KCollins would charge Cincinnati is:

a) $98

b) $167

c) $250

d) $280

(HOCK)

Sell or Process Further Decisions

If the decision is between selling the product "as-is" or processing it further, presumably in order to sell it for a higher price, the decision is based on the incremental operating income that is attainable beyond the "as-is" point. This kind of situation may be encountered when dealing with joint production process or obsolete inventory.

Joint Production Process

A joint production process results when the same production process (and therefore the same costs of that production process) yields more than one product. For example, the processing of petroleum yields crude oil, gas and raw liquid propane gas. The further processing of the crude oil may yield heating oil, lubricating oil and various petrochemicals. With **joint costs** (these are the costs that are shared by the joint production process), the place in the production process where the various products become individually identifiable is called the **splitoff point**. Costs incurred up to the splitoff point are joint costs. Costs incurred after the splitoff point are **separable costs**.

The products of a joint manufacturing process may have value at the splitoff point, and they may also have greater value if processed further as separate products. The decision needs to be made as to whether they will be sold at the splitoff point, or whether they will be processed further and then sold.

When joint costs have already been incurred for a product, management making a decision to process further or sell at the splitoff point should not even consider the joint costs or the portion of those joint costs that have been allocated to the individual products. This is because these are **sunk** costs. The only factors that are relevant are **incremental** revenues and costs. The increased revenues attainable by processing further should be balanced against the increased costs to process further. The increase in net operating income as a result of the additional processing is the only basis for the decision.

Obsolete Inventory

With obsolete inventory, the original cost of the inventory is a sunk cost and is irrelevant. If the choice is between selling the inventory "as-is" for whatever price it can bring versus re-working it, compare the revenue from selling minus the cost of re-working it with the proceeds from selling the inventory as-is (or the cost of disposal, if the inventory has no value). It is better to process further or incur additional other costs **if** the sale of the re-worked product at the expected price is certain, and

1) If incremental revenues for re-worked product minus incremental expenses of re-work is greater than the proceeds would be from selling as-is; or

2) If there is a cost to dispose of the obsolete inventory instead of any proceeds, the difference between the two options will be the **sum** of the absolute values of the net of incremental revenue minus incremental expense and the cost to dispose.

If income tax is a consideration, then the difference in the net cash flow will need to be adjusted for the tax effects on each option; and this would require calculation of taxable income or loss. However, the book value of the inventory is used **only** to calculate taxable income or loss — it is not a factor in the comparison of relevant incremental revenues and costs because it is a sunk cost.

Example 1: CCC Computers has ten computers in inventory that are obsolete. CCC Computers purchased the computers four years ago for its inventory at a cost of $800 but has never been able to sell them. The company has a customer who would buy them for $175 each if CCC upgrades them; or CCC could sell them to another customer "as is" for $100 each. The cost to upgrade the computers would be $100 per computer, including labor. CCC Computer's tax rate is 40%. Would the company be better off selling the computers now for $100 each or upgrading them and selling them for $175 each; and how much is the difference?

	A Sell Now	B Upgrade & Sell	B – A Difference
Revenue	$1,000	$1,750	+$ 750
Less: Cost to upgrade	0	1,000	+ 1,000
Cash flow from sale	**$1,000**	**$750**	**–$ 250**
Less: Cost of goods sold	$8,000	$8,000	0
Taxable income/(loss)	*(7,000)*	*(7,250)*	– *250*
Income tax benefit	**2,800**	**2,900**	**+ 100**
Net cash flow after tax	**$3,800**	**$3,650**	**–$ 150**

The tax loss is relevant to the decision only because they will shelter other income from tax. This means that this loss will be used to offset other profit and will reduce the total tax liability of the company. After tax considerations, CCC would be better off selling the computers now, because its net after tax cash flow would be $150 greater than if they upgrade and sell them.

Example 2: Assume the same facts as before, except CCC Computers has no customer to purchase the computers in their present state. They could sell them to the same customer as above for the same $175 after upgrading them. CCC must get rid of the computers to make room for new merchandise. Since the computers contain toxic components, they would have to be sent to a recycling center that will charge $15 per computer to recycle them. Now, the choice is between upgrading and selling them, or paying a recycler. Which way is CCC better off, and by how much?

	A Recycle	B Upgrade & Sell	B – A Difference
Revenue	$ 0	$1,750	+$1,750
Plus: Additional cost	150	1,000	+ 850
Cash flow from sale	**($150)**	**$750**	**+$ 900**
Less: Cost of goods sold	$8,000	$8,000	0
Taxable income/(loss)	*(8,150)*	*(7,250)*	+ *900*
Income tax benefit	**3,260**	**2,900**	**– 360**
Net cash flow after tax	**$3,110**	**$3,650**	**+$ 540**

Because CCC would have to pay to dispose of the computers, it is better off upgrading and selling them.

Disinvestment Decisions

When making a decision whether to terminate a product, division or operation, the decision-making process is very similar to the decisions we have already looked at. It is simply a matter of determining what the profit (or cost, depending on the way the question is set up) would be under both the current situation and what it would be if the product, division or operation were terminated. The decision can then be made based upon which option provides a greater benefit for the company.

In this decision-making process, it is critical to remember that some of the fixed costs of the division may not be avoided even if the division is terminated. This is because some of the fixed costs may be allocations of central fixed costs or are costs that cannot be terminated (such as a non-cancelable lease). Because those costs will simply be transferred to another division if the division in question is terminated, these are not avoidable costs.

There are three main steps that a company must follow in this process:

1) **Identify any unavoidable fixed costs** that are allocated to or incurred by the division that would continue even if the division were terminated. These are the unavoidable costs that would simply be transferred to another division if this division were terminated.

2) **Identify any unavoidable variable costs** that would continue even if the division were terminated. These are again the unavoidable variable costs that would be absorbed by another division after this one is closed.

3) **Identify any avoidable costs** (both fixed and variable) that will be incurred only if the division continues to operate and compare this to the **revenue of the division**. If the revenue from this division is less than the avoidable costs of the division, the division should be terminated.

   Step 3 essentially calculates the **contribution of the division**. If the revenue is greater than the costs that are incurred only if the division operates, the company as a whole is better off because there is contribution that is able to contribute to the coverage of the fixed costs of the company as a whole.

> Note: The division does not need to be profitable from a "bottom-line" standpoint for it to be beneficial to continue. As long as the division is providing some amount of contribution to the continuing fixed costs of the company, it should be continued in the short-run because the company's overall profitability would increase.

What the company is doing is determining whether the marginal revenues (the revenues that will be received only if they allow the division to continue) are greater than the marginal costs of the project or division (the costs that are incurred only if the division continues). If the marginal costs are greater than the marginal revenues, then the division should be closed (or the product eliminated, whatever the case may be).

On the exam, you will need to calculate the amount by which a company's contribution, i.e., profit, or in some cases costs, will increase or decrease as a result of specific actions (such as the termination of a division). The best way to approach this problem is to calculate the requested information **for both possibilities** (to discontinue or to not discontinue) and then compare the results.

> Note: In addition to these numerical calculations about the benefit or cost of closing a division, there are also nonfinancial considerations that need to be included in the decision-making process. These may include the impact on a local community, public opinion, longer-term corporate goals and other similar items.

The following information is for the next three Questions: Condensed monthly operating income data for Korbin Inc. for May follows:

	Urban Store	Suburban Store	Total
Sales	$80,000	$ 120,000	$200,000
Variable costs	32,000	84,000	116,000
Contribution margin	$48,000	$ 36,000	$ 84,000
Direct fixed costs	20,000	40,000	60,000
Store segment margin	$28,000	$ (4,000)	$ 24,000
Common fixed cost	4,000	6,000	10,000
Operating income	$24,000	$(10,000)	$ 14,000

Additional information regarding Korbin's operations follows:

- One-fourth of each store's direct fixed costs would continue if either store were closed.
- Korbin allocates common fixed costs to each store on the basis of sales dollars.
- Management estimates that closing the Suburban Store would result in a 10% decrease in the Urban Store's sales, while closing the Urban Store would not affect the Suburban Store's sales.
- The operating results for May are representative of all months.

Question 9: A decision by Korbin to close the Suburban Store would result in a monthly increase (decrease) in Korbin's operating income of:

a) $(10,800)

b) $(1,200)

c) $(6,000)

d) $4,000

Question 10: Korbin is considering a promotional campaign at the Suburban Store that would not affect the Urban Store. Increasing annual promotional expense at the Suburban Store by $60,000 in order to increase this store's sales by 10% would result in a monthly change in Korbin's income of:

a) $(5,000)

b) $(1,400)

c) $7,000

d) $487

Question 11: One-half of the Suburban Store's dollar sales are from items sold at variable cost to attract customers to the store. Korbin is considering the deletion of these items, a move that would reduce the Suburban Store's direct fixed expenses by 15% and result in a 20% loss of the Suburban Store's remaining sales volume. This change would not affect the Urban Store. A decision by Korbin to eliminate the items sold at cost would result in a monthly increase (decrease) in Korbin's operating income of:

a) $(7,200)

b) $(1,200)

c) $2,000

d) $(5,200)

(CMA Adapted)

The following information is for the next two Questions: Hermo Company has just completed a hydroelectric plant at a cost of $21,000,000. The plant will provide the company's power needs for the next 20 years. Hermo will use only 60% of the power output annually. At this level of capacity, Hermo's annual operating costs will amount to $1,800,000, of which 80% are fixed.

Quigley Company currently purchases its power from MP Electric at an annual cost of $1,200,000. Hermo could supply this power, thus increasing output of the plant to 90% of capacity. This would reduce the estimated life of the plant to 14 years.

Question 12: If Hermo decides to supply power to Quigley, it wants to be compensated for the decrease in the life of the plant and the appropriate variable costs. Hermo has decided that the charge for the decreased life should be based on the original cost of the plant calculated on a straight-line basis. The minimum annual amount that Hermo would charge Quigley would be:

a) $450,000

b) $630,000

c) $990,000

d) Some amount other than those given.

Question 13: The maximum amount Quigley would pay Hermo annually for the power is:

a) $600,000

b) $1,050,000

c) $1,200,000

d) Some amount other than those given.

(CMA Adapted)

Pricing

Determining the selling price of a product is one of the most critical decisions a company makes. If the price is too high, the company runs the risk of not selling enough units and losing money, even though they make a lot of profit on each unit sold. If the price is too low, there is the risk that the company will not cover all of its costs and will lose money even though they are selling a lot of units.

This decision is even **more critical for start-up companies** as they usually do not have a large cash reserve to cover any pricing mistakes in the short-term.

In general, the price of a product or service is dependent upon its **demand** and **supply**. The three major influences on price are often labeled as the "Three Cs":

- **Customers.** Customers' desire for the product and their willingness to pay for it constitutes demand. When a product is in high demand, its supply becomes limited, and the price is driven up.
- **Competitors.** Prices charged by competitors for substitute products, or **market comparables**, affect the demand as well as the price a company can charge for its product. If a competitor's price is significantly below the market price, demand for the output of a company in the same market will be decreased. The company may be forced to lower its price to stay in business.
- **Costs.** Costs of production affect supply. The lower the cost, the higher the profit, and the more product the company will be willing to supply. In managing their costs the company needs to try to reduce and eliminate all of the costs that do not add value to the final product.

All three factors are important when setting prices: the value that customers place on the product, and thus are willing to pay, and the prices competitors charge for competing products **affect demand**, while the costs of producing and delivering the product **influence supply**.

Impact of Market Structure on Pricing

We discussed market structure earlier in the context of marginal revenue. Marginal revenue is affected by the market structure of an industry because market prices are set differently under the different market structures. The market structures are covered in detail in the HOCK *Assumed Knowledge* e-book, vol. 1, so they will be discussed briefly here as they pertain to pricing.

Perfect competition –Sellers in a perfectly competitive market can sell as much of their product as they want to at the market price, but they must sell at the market price. If they try to charge more than the market price, they will sell nothing. If they drop their price below the market price, they can still sell as much of their product as they want to. But if they drop their price below the market price, their total revenue will be lower than it could have been, because they could have sold the same amount at the market price and earned more total revenue. Therefore, pricing decisions for a firm in a perfectly competitive market are easy – the perfectly competitive firm is a price taker and simply sells at the market price. However, and this is a big "however" – perfect competition is a theoretical market structure. There probably are no perfectly competitive firms. The closest any market comes to being perfectly competitive is the agricultural market, where farmers bring their produce to market when it is ready to sell, and most of them must sell it at the market price or it will spoil.

Monopoly –A monopoly has control over the price it charges, in contrast to the perfectly competitive firm that must sell its product at the market price. However, even though the monopolist has control over the price it charges, it cannot increase prices and expect to sell the same amount of product. The monopolist faces a downward sloping demand curve, and when it increases its prices, it sells fewer units. Similarly, when it decreases its prices, it will sell more units.

Monopolistic Competition – There are many firms operating in the market, and they do not collude with one another in setting prices. The products produced by the various firms are similar but not identical. There are differences among them. The firms in the market have limited control over prices, even though there are many firms, because of the differences in the products. One firm can charge more than another one because of offering more features, and so forth. A firm in monopolistic competition must also drop its price in order to sell additional units, although this is mitigated somewhat by the product differentiation.

Oligopoly – In an oligopoly, there are only a few firms operating in the market and each company will consider the impact of its actions on its competitors and the reaction that it expects from its competitors. A price decrease by one company will usually be matched by others' price decreases, but a price increase by one company will usually not be followed by the other companies.

Thus, if one firm increases its price, it will lose volume to the other producers since they will not increase their prices and thus they will secure more volume. If the other firms did not match the lower price, a price decrease by one firm would allow that firm to capture more of the market. However, competitors tend to match a price decrease; so any increase in volume that the firm would received would not be enough to offset the lower price, and total revenue will decrease.

Given that there is a negative effect to either increasing or decreasing the price, prices in an oligopoly tend to be "sticky" (meaning that they do not change easily).

Impact of Supply and Demand on Pricing

Supply and demand are covered in detail in the HOCK *Assumed Knowledge* e-book. Some highlights are reviewed here.

Demand

The **law of demand** states that the price of a product is inversely (negatively) related to the quantity demanded of that same product. Therefore, as the price of the product is reduced, the quantity demanded for that same product will increase, and vice versa.

This is represented on a graph as a downward sloping line. Monopolistic firms, monopolistically competitive firms and oligopolistic firms all face downward sloping demand curves. A firm operating in an oligopoly faces a "kinked" demand curve but it is, nonetheless, downward sloping.

Elasticity of Demand

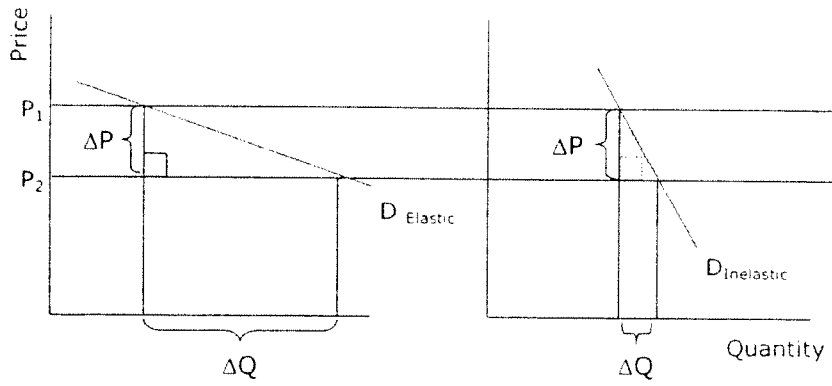
The **elasticity** of the demand for a particular product or service will determine how much effect a price increase or decrease will have on the demand for that product or service. Elasticity of demand is calculated in general as the percentage change in quantity demanded divided by the percentage change in price.

The demand for a product is said to be "**elastic**" ("responsive") if a 1% change in the price of the good causes **more than** a 1% change in the quantity demanded. More generally, the demand for a product is *elastic* if the quantity demanded changes by a *larger percentage* than the associated change in the product's price. Therefore, if the demand for a good is elastic, the price elasticity of demand will be greater than 1.

Similarly, the demand for a product is said to be "**inelastic**" ("unresponsive") if a 1% change in the price of the good causes **less than** a 1% change in the quantity demanded. More generally, the demand for a product is *inelastic* if quantity demanded changes by a *smaller percentage* than the associated change in the product's price. Therefore, if the demand for a good is inelastic, the price elasticity of demand will be less than 1.

The concept of elasticity is shown in the graphs that follow. The demand curve on the left is relatively elastic because a small change in price leads to a large change in the quantity demanded. The curve on the right has only a small change in the quantity demanded given a larger change in price, so it is relatively inelastic.

Elastic vs. Inelastic Demand Curves



A perfectly elastic demand curve is represented by a horizontal demand line on a graph, whereas a perfectly inelastic demand curve is represented by a vertical demand line on a graph.

Calculating the Elasticity of Demand

There are two ways in which the price elasticity can be calculated. The two methods are the percentage method and the midpoint (or arc) method and they produce similar results. However the midpoint method is less precise because it relies upon approximation. Though the two methods will give a slightly different result, the overall effect, whether the outcome is elastic or inelastic, will be preserved.

For the exam, you should know the midpoint formula. We will discuss the percentage method as well, though, to assist in your understanding of the concept.

The Percentage Method

Under the percentage method we simply take the % change in quantity and divide it by the % change in the price of the product. This method is used if percentages are given.

The Price Elasticity of Demand (E_d) – Percentage Method

$$E_d = \frac{\text{Percentage Change in Quantity Demanded}}{\text{Percentage Change in Price}} = \frac{\%\Delta Q}{\%\Delta P}$$

Note: Following the law of demand, which is that the demand curve is downward sloping, the elasticity coefficient (E_d) calculated **by the formula is negative since, for example, lower prices (a "negative" change in price) will bring about a higher quantity demanded (a "positive" change in quantity).** The absolute value is typically used when interpreting E_d, meaning that when the effects of price changes on the quantity demanded for a **single** good is calculated, the number is always considered to be positive.

The Midpoint (or Arc) Method

The midpoint method is used when we are given different numerical and dollar figures for different points on the demand curve. This method also eliminates the fact that the percentage method will give different elasticities, depending upon the direction of the movement along the curve that is used in the calculation. This method is less accurate due to approximation of the midpoint.

The Price Elasticity of Demand (E_d) – Midpoint Method

$$E_d = \frac{(Q_2 - Q_1) / [(Q_2 + Q_1) / 2]}{(P_2 - P_1) / [(P_2 + P_1) / 2]}$$

Where: $Q_{1 \text{ and } 2}$ = First and second quantity point
$P_{1 \text{ and } 2}$ = First and second price point

Example: Let us assume the following information for two points along the demand curve:

Point A: Price = \$4; Quantity = 120

Point B: Price = \$5; Quantity = 80

The calculation of elasticity using the midpoint method is done as follows:

$$E_d = \frac{(80 - 120) / [(80 + 120) / 2]}{(5 - 4) / [(5 + 4) / 2]} = \frac{40 / 100}{1 / 4.5} = 1.80$$

Classifications of Levels of Elasticity

Once the elasticity coefficient has been calculated, it can be classified as one of the following:

$E_d = 0$	**Perfectly Inelastic** – This means that no matter what happens to the price, the quantity that is demanded will remain the same. For a market, this situation is quite unlikely. However, some individual consumers may have a near zero elasticity of demand for certain goods. Example: a diabetic's demand for insulin (given the importance of insulin to the user's health, and the fact that there are no reasonable substitutes for insulin).
$E_d < 1$	**Inelastic** – Any given percentage change in price will result in a *smaller* percentage change in the quantity demanded. Example: a 9% decrease in price will cause the quantity demanded to rise by less than 9%.
$E_d = 1$	**Unitary Elasticity** – Any given percentage change in price will cause the quantity demanded to change by the same percent. Example: a 12% increase in price will cause the quantity demanded to fall by exactly 12%.
$E_d > 1$	**Elastic** – Any given percentage change in price will result in a *larger* percentage change in the quantity demanded. Example: a 2.5% decrease in price will cause the quantity demanded to rise by more than 2.5%.

Note: While it is unlikely that the **market demand** for a good would ever be **infinitely elastic** (that is, an essentially unlimited demand for the product at one price, but a zero quantity demanded at any higher price), the demand for a **single perfectly competitive firm** can best be described as infinitely elastic. Consider for example "white socks." Suppose the market for white socks is perfectly competitive. If the market price for white socks in equilibrium is $2 per pair, any single producer of white socks - being such a small part of the larger market - operates as if it can sell as many pairs of white socks as it desires at the price of $2. If any firm tried to sell white socks for more than $2 per pair, the demand for its socks would fall to zero, since consumers will simply buy their socks from one of the many other firms selling white socks for $2 per pair. As a result, graphically the demand curve for a single firm operating within this perfectly competitive industry is best represented by a horizontal line at the price of $2, which suggests an infinite elasticity of demand.

Question 14: If a product has a price elasticity of demand of 2.0, the demand is considered to be:

a) Perfectly elastic.

b) Perfectly inelastic.

c) Relatively elastic.

d) Relatively inelastic.

(CMA Adapted)

Question 15: If the pastry shop has increased its price for a brioche from $2 to $2.30, what would the elasticity of 1.9 imply about the quantity of these brioches sold:

a) Demand for the brioches is inelastic, so price changes do not affect quantity.

b) Given the relatively elastic demand, percentage change decline in quantity is 28.5.

c) Given the relatively elastic demand, percentage change decline in quantity is 7.9.

d) This change in price of the brioche would imply an increase in the quantity sold.

(HOCK)

Elasticity and Total Revenue

The mathematical relationship between price changes and changes in total revenue is dependent upon the elasticity of demand. The total revenue formula is one that is fairly straightforward:

$$\text{Total Revenue} = \text{Price} \times \text{Quantity}$$

Given this equation, we can see how the elasticity of demand will impact the total revenues. If we raise the price, we know that quantity will fall. However, the most important question is whether total revenue will increase or decrease as a result.

Recall that the elasticity of demand tells us the percentage change in quantity demanded (e.g., sales) that will occur for some given percentage change in price. If demand is elastic, the quantity demanded will change by a larger percentage than a good's price. To see the relationship between elasticity and revenue, suppose the elasticity of demand for DVD players is 2. If the price of DVD players falls by 6%, this suggests that the quantity of DVD players demanded (sold) will rise by 12%. The 6% decrease in price is more than offset by the 12% increase in sales (quantity), so Total Revenue rises. On the other hand, if the price of DVD players were to increase by 8%, sales (the quantity) demanded would fall by 16%, and this would push Total Revenue down. Thus, when demand is elastic, Total Revenue rises when price falls (output rises), and Total Revenue falls when price increases (output falls).