1. Winter Enterprises manufactures and sells three types of heaters: Standard, Star, and Supreme. Two service departments, human resources (HR) and information system (IS), provide support to two operating departments, Machining and Engineering. The company uses the reciprocal method to allocate service department costs to operating departments. The allocation base used for HR department is number of employees, and the allocation base used for IS department is computer hour. The following figure summarizes the amount of allocation base used by each department.

	Machining	Engineering	IS	HR
Computer hour	1,000	2,000	-	5,000
Number of employees	24,000	36,000	40,000	-

Operating department costs are allocated to products using an activity-based costing system. The controller establishes three activity pools: machine setup, machine operation, and quality control. Each type of heater is assembled by machine and inspected for quality assurance after assembly. The following data pertains to the three products:

	Standard	Star	Supreme
Total production units	3,000	500	400
Direct materials per unit (pound)	2.0	3.0	6.0
Direct labor hour per unit	1.0	0.4	1.0
Machine hour per unit	1.5	2.2	1.0
Number of units per batch	1,000	500	80
Setup hour per batch	3.0	5.0	4.4
Inspection hour per unit	2.0	4.0	5.0

Additional information:

- Service costs of HR and IS departments respectively amount to $990,000 and $360,000. The service costs allocated to Machining department are allocated to products based on machine hours, and the service costs allocated to Engineering department are allocated to products based on direct labor hours.
- The overhead costs incurred directly in the operating departments include $90,000 in machine setup, $720,000 in machine operation, and $500,000 in quality control.
- Material costs $20 per pound. Direct labor wage rate is $10 per hour.

Required: Determine the total cost per unit of Star. **(10%)**

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2. Kiwi Corporation adopts standard absorption costing system. Just before the controller's regular review of monthly operating performance, the company experienced a computer system crash. The computer engineer retrieved some of the information and presented a performance report as follows:

	Direct Material	Direct Labor	Variable Overhead	Fixed Overhead
Standard usage per unit.....		2 hours		
Standard cost	$12 per kilogram	$14 per hour		
Flexible budget				$40,000
Actual total usage	14,400 kilograms	8,100 hours		
Actual total cost	$180,000			
Direct material quantity variance		$10,800 U		
Direct labor rate variance		$8,100 U		
Direct labor efficiency variance		$12,600 F		
Variable-overhead spending variance			$8,100 F	
Variable-overhead efficiency variance			$5,400 F	
Fixed-overhead flexible-budget variance				0

In addition to the above fragmentary data, the controller also gathered the following information:

- Planned production was 500 units more than the actual production.
- All of the direct material purchased was used in production.
- There were no beginning or ending inventories.
- Variable and fixed overhead are applied on the basis of direct labor hours. The fixed overhead rate if $4 per hour.
- The company sold the product at a price of $116, which met the budget. There were no other operating expenses.

Required:

(1) Determine the fixed-overhead production-volume variance. **(10%)**

(2) Based on the standard data, calculate the contribution margin per unit. **(10%)**

(3) Based on the actual data, calculate the breakeven point in units. **(10%)**

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3. Stone Chemical Company manufactures three industrial chemical products in a joint process. In January, 15,000 tons of inputs were processed at a cost of $660,000. The joint process results in three chemical products: Alpha, Beta, and Gamma. Alpha is fully processed further at a cost of $120,000 and Beta is sold without further processing. Gamma is considered a byproduct and the company recognizes the sales revenue of Gamma when the product is sold, which results in a net realizable value of $30,000. Currently the company uses the physical measure method to allocate $132,000 of the joint costs to Beta, which yields a gross margin percentage of 72.5% under this method. Total gross margin of the company is $570,000.

Required: If the company allocates the joint costs based on the net realizable value (NRV) method and accounts for the byproduct using the production method, calculate the amount of joint costs allocated to Alpha. **(10%)**

4. Fantastic Company is a toy manufacturer with single production department. The company uses the weighted-average method of process costing. In July, the following data were recorded for the production department:

Beginning work in process	10,000 units
Units started	50,000 units
Units completed	45,000 units
Ending work in process	9,000 units
Spoilage	6,000 units
Beginning work-in-process:	
Cost of direct materials	$ 24,000
Conversion cost	$ 8,000
Total cost added during July	
Cost of direct materials	$120,000
Cost of direct manufacturing labor	$ 32,000

Beginning work in process was half complete as to conversion. Direct materials are added at the beginning of the process. Conversion costs are added evenly during the process. Factory overhead is applied at a rate equal to 60% of direct manufacturing labor. Ending work in process was 90% complete as to conversion. The inspection point is at the 80% stage of production. Normal spoilage is 10% of all good units that pass inspection. Spoiled units have no net disposal value.

Required: (Round your equivalent cost per unit to the nearest thousandth.)

For July, determine the total costs assigned to:

(1) Abnormal spoilage **(5%)**, and

(2) Units in ending work in process (including normal spoilage) **(10%)**.

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5. Continental Corporation manufactures two products: X and Y. The management imposes a policy of filling all sales orders, even if it means purchasing units from outside suppliers. There is no difference in quality between products purchased from an outside supplier and those manufactured by the firm. Continental expects 48,000 machine hours are available in the coming year. Data pertaining to the two products for the coming year are summarized as follows:

	X	Y
Unit sales price	$150	$100
Direct material per unit	14	8
Direct labor per unit	10	6
Variable manufacturing overhead per unit (applied at a rate of $6 per machine hour)	12	6
Fixed manufacturing overhead per unit (applied at a rate of $5 per machine hour)	10	5
Variable non-manufacturing costs per unit	2	3
Fixed non-manufacturing costs per unit (allocated at a rate of $3 per unit)	3	3
Unit Cost if purchased from an outside supplier	50	30
Annual demand (units)	25,000	20,000

Required:

(1) To maximize the firm's profit in the coming year, how many units of X should the firm manufacture? **(5%)** How many units of Y should be purchased from an outside supplier? **(5%)**

(2) With all other conditions the same, suppose the management is able to reduce the direct material for each X to $6 per unit. To maximize the firm's profit in the coming year, how many units of X should the firm manufacture? **(5%)** How many units of Y should be purchased from an outside supplier? **(5%)**

6. Frontier Corporation manufactures scientific equipment for use in research labs. To improve production efficiency, the management is considering the acquisition of a robotic machine. The initial investment amounts include the acquisition costs of $190,000 and the working capital of $40,000. Its estimated useful life is five years and will have a salvage value of $25,000. Straight-line depreciation method will be used for the machine. Recovery of working capital $40,000 will be at the end of its useful life. Annual cash savings from the purchase of the machine will be $60,000. Assume all cash flows occur at year-end except for initial investment amounts. Frontier has a required rate of return of 12%.

Required:

(1) Determine the net present value of the investment in the robotic machine. **(10%)**

(2) Determine the internal rate of return from the investment in the robotic machine. **(5%)**

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