

**Automated
Cost
Estimates**

ACE

PRESENTATION SYNOPSIS

- ▶ Definition
- ▶ Purpose
- ▶ Products Derived
- ▶ Concept
- ▶ Assumptions
- ▶ Functional Definitions
- ▶ Symbolic Equations
- ▶ Mathematical Relationships
- ▶ Generalized Schematic
- ▶ Data Processing Example
- ▶ Characteristics
- ▶ Reliability

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TSL-107-12/64

DEFINITION

It is a means of forecasting research and development and engineering services cost and direct manhours. More precisely, it is a computer application employing mathematical methods of calculating various cost and DMH relationships and behavior trends; automatically selecting the network that will produce the best calculated forecast based upon historical data.

TREND

RATE OF FIRE PER MINUTE

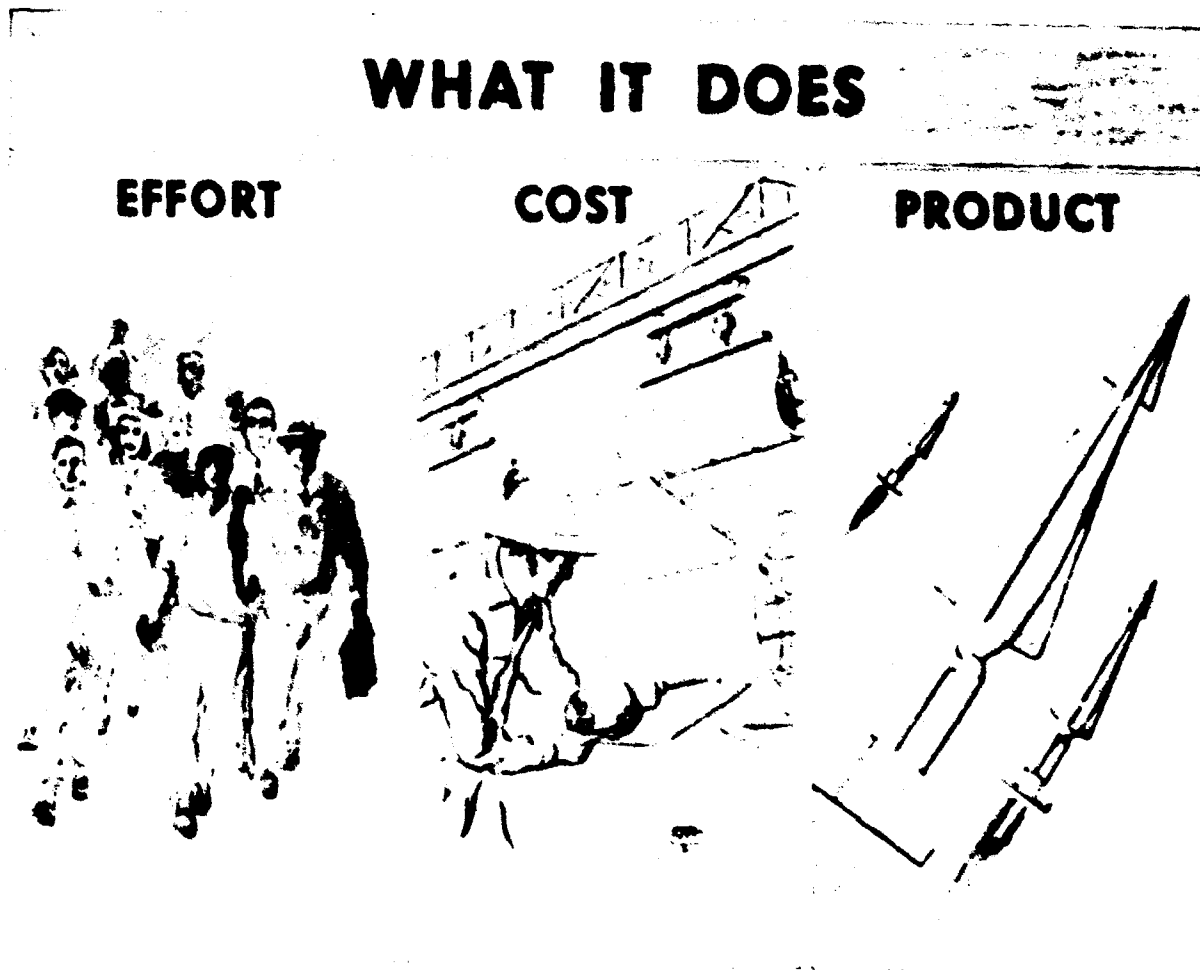


PURPOSE

Forecast to contractor's estimated contract completion date:

Cumulative DMH	In Relation to Time Periods
Cumulative Dollars	
*Overrun/Underrun	

*Dollars/Mannours - provided contractor furnishes an estimate.



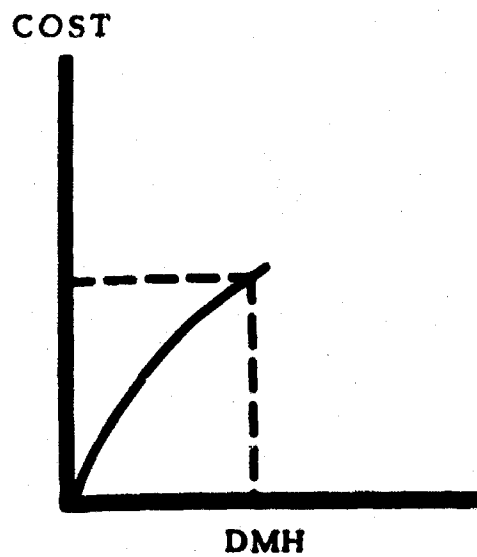
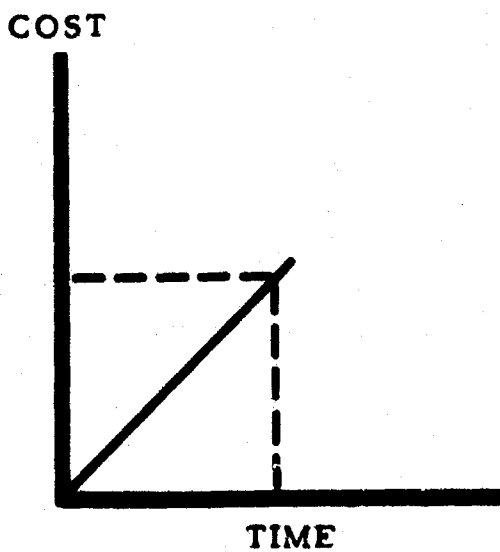
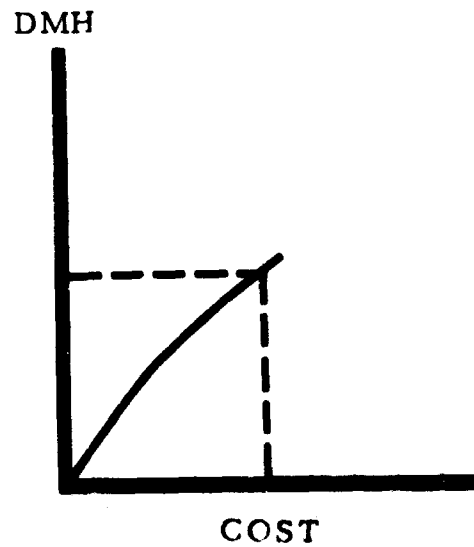
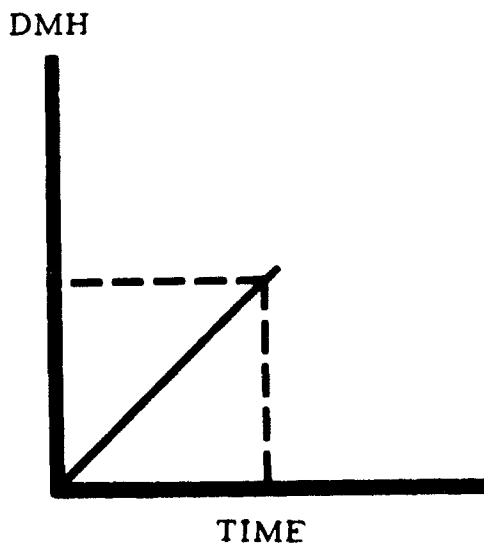
PRODUCTS DERIVED

CONTRACTOR'S NAME				
MISSILE SYSTEM				
R & D				
TOTAL				
-ACTUAL-				
DATE	COST	DMH	\$/DMH	% CONTRACT VALUE
1 QR 61	\$ 1,631.	243.	6.71	.85
2 QR 61	4,654.	542.	8.58	2.44
3 QR 61	10,432.	1,043.	10.00	5.47
4 QR 61	17,445.	1,686.	10.35	9.14
1 QR 62	25,769.	2,495.	10.33	13.51
2 QR 62	36,261.	3,700.	9.80	19.01
3 QR 62	49,150.	4,792.	10.25	25.77
-FORECAST (ACE)-				
3 QR 62	62,213.	6,067.	10.25	32.62
4 QR 62	76,655.	7,476.	10.25	40.19
1 QR 63	92,444.	9,017.	10.25	48.47
2 QR 63	109,551.	10,678.	10.25	57.44
3 QR 63	127,952.	12,482.	10.25	67.09
4 QR 63	147,625.	14,402.	10.25	77.40
1 QR 64	168,550.	16,444.	10.25	88.38
Contract Dollar Value \$190,707.				
Underrun \$22,157. beginning 1 QR 64				

In addition to this report for "Total", the same product can be run for manufacturing, tooling, and engineering, provided the following criteria is adhered to: Direct manhour input is in relation to dollar input for a specific, consistent time period, e.g., total DMH for 1QR61, total dollars for 1QR61. Additional data input requirements: (1) Contractor's estimated completion date; (2) Total contract value.

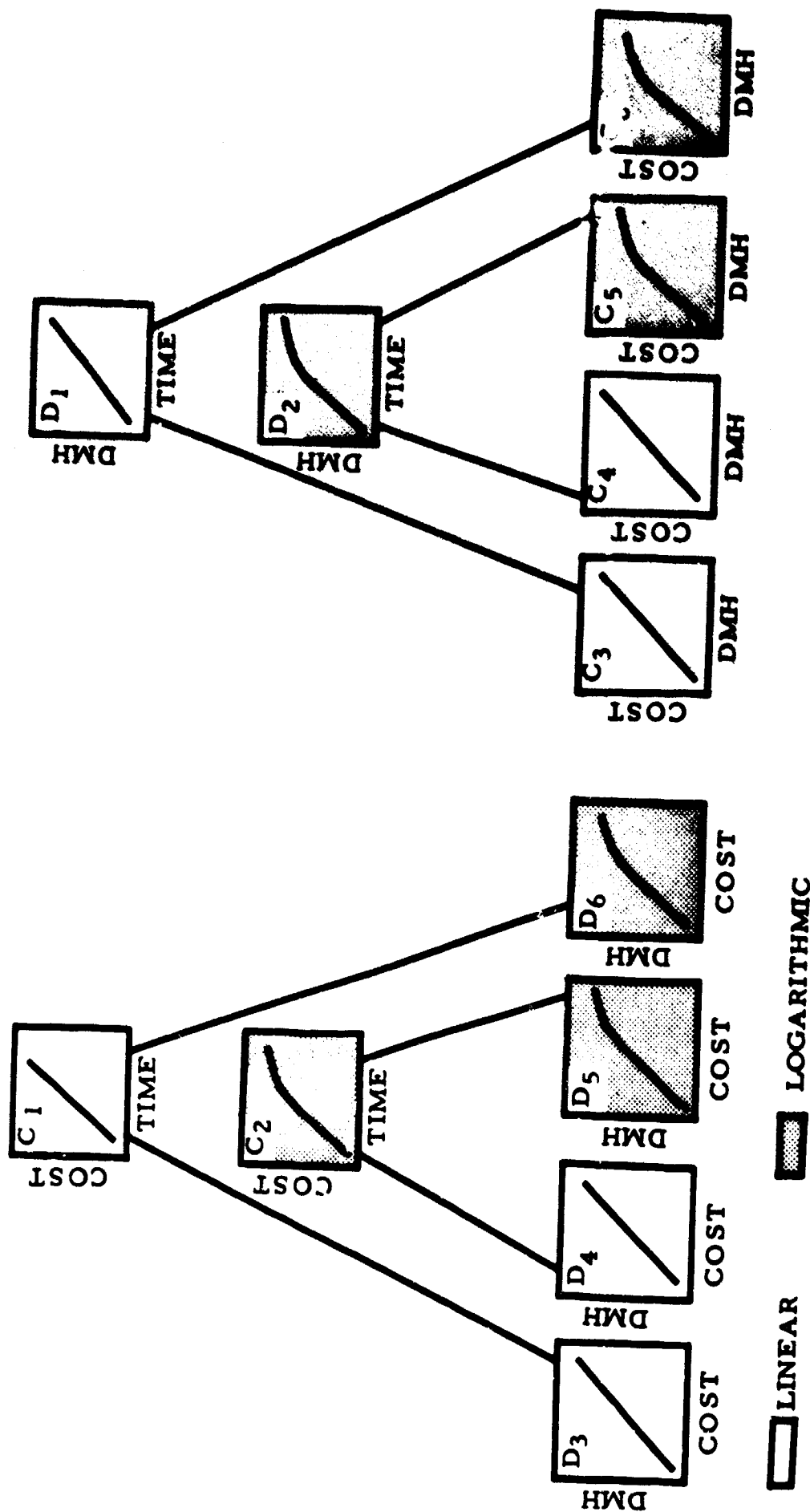
CONCEPT

The concept of ACE evolves from the theory there are significant linear and logarithmic relationships of; direct manhours, dollars and time. A graphic portrayal is the chart shown:



ASSUMPTIONS

Acceptance of the data relationship theorem prompts the assumption this may be expressed schematically as linear and logarithmic relationships:



FUNCTIONAL DEFINITIONS

1. Time = Successive numeric values assigned to each unit (or incremental period) from a specific starting point to a specific ending point; e.g. 3QR60=1, 4 QR60=2, 1QR61=3.
2. Cost = The dollar expenditure for each expression of time.
3. DMH = The direct manhour expenditure for each expression of time.
4. A = The initial value of dollars, direct manhours expended in the first time period, (Intercept).
5. B = The ratio between dollars, DME, and successive time periods, (Slope).

LINEAR

- A₁ = Time-Cost Initial Value
- B₁ = Time-Cost Ratio
- A₃ = Time-DMH Initial Value
- B₃ = Time-DMH Ratio
- A₅ = DMH-Cost Initial Value
- B₅ = DMH-Cost Ratio
- A₇ = Cost-DMH Initial Value
- B₇ = Cost-DMH Ratio

LOGARITHMIC

- A₂ = Time-Cost Initial Value
- B₂ = Time-Cost Ratio
- A₄ = Time-DMH Initial Value
- B₄ = Time-DMH Ratio
- A₆ = DMH-Cost Initial Value
- B₆ = DMH-Cost Ratio
- A₈ = Cost-DMH Initial Value
- B₈ = Cost-DMH Ratio

SYMBOLIC EQUATIONS

N = Number of Points

$$B = \frac{NS^*XY - SX \cdot SY}{NSX^2 - (SX)^2}$$

$$A = \frac{SY - B \cdot SX}{N}$$

$$B_1 = \frac{N \cdot S \cdot (Time \cdot Cost) - S \cdot (Time) \cdot S \cdot (Cost)}{N \cdot S \cdot (Time)^2 - (S \cdot (Time))^2}$$

$$A_1 = \frac{S \cdot (Cost) - B_1 \cdot S \cdot (Time)}{N}$$

$$B_2 = \frac{N \cdot S \cdot (Log \ Time \cdot Log \ Cost) - S \cdot (Log \ Time) \cdot S \cdot (Log \ Cost)}{N \cdot S \cdot (Log \ Time)^2 - (S \cdot (Log \ Time))^2}, A_2 = \frac{LOG^{-1}(S \cdot (Log \ Cost) - B_2 \cdot S \cdot (Log \ Time))}{N}$$

$$B_3 = \frac{N \cdot S \cdot (Time \cdot DMH) - S \cdot (Time) \cdot S \cdot (DMH)}{N \cdot S \cdot (Time)^2 - (S \cdot (Time))^2}$$

$$A_3 = \frac{S \cdot (DMH) - B_3 \cdot S \cdot (Time)}{N}$$

$$B_4 = \frac{N \cdot S \cdot (Log \ Time \cdot Log \ DMH) - S \cdot (Log \ Time) \cdot S \cdot (Log \ DMH)}{N \cdot S \cdot (Log \ Time)^2 - (S \cdot (Log \ Time))^2}, A_4 = \frac{LOG^{-1}(S \cdot (Log \ DMH) - B_4 \cdot S \cdot (Log \ Time))}{N}$$

$$B_5 = \frac{N \cdot S \cdot (DMH \cdot Cost) - S \cdot (DMH) \cdot S \cdot (Cost)}{N \cdot S \cdot (DMH)^2 - (S \cdot (DMH))^2}$$

$$A_5 = \frac{S \cdot (Cost) - B_5 \cdot S \cdot (DMH)}{N}$$

$$B_6 = \frac{N \cdot S \cdot (Log \ DMH \cdot Log \ Cost) - S \cdot (Log \ DMH) \cdot S \cdot (Log \ Cost)}{N \cdot S \cdot (Log \ DMH)^2 - (S \cdot (Log \ DMH))^2}, A_6 = \frac{LOG^{-1}(S \cdot (Log \ Cost) - B_6 \cdot S \cdot (Log \ DMH))}{N}$$

$$B_7 = \frac{N \cdot S \cdot (Cost \cdot DMH) - S \cdot (Cost) \cdot S \cdot (DMH)}{N \cdot S \cdot (Cost)^2 - (S \cdot (Cost))^2}$$

$$A_7 = \frac{S \cdot (DMH) - B_7 \cdot S \cdot (Cost)}{N}$$

$$B_8 = \frac{N \cdot S \cdot (Log \ Cost \cdot Log \ DMH) - S \cdot (Log \ Cost) \cdot S \cdot (Log \ DMH)}{N \cdot S \cdot (Log \ Cost)^2 - (S \cdot (Log \ Cost))^2}, A_8 = \frac{LOG^{-1}(S \cdot (Log \ DMH) - B_8 \cdot S \cdot (Log \ Cost))}{N}$$

*S = Summation

MATHEMATICAL RELATIONSHIPS

COST

$$C1 = A1 + \text{Time} \cdot B1$$

$$C2 = A2 \cdot (\text{Time})^{B2}$$

$$(D1) = A3 + \text{Time} \cdot B3$$

$$C3 = A5 + (D1) \cdot B5$$

$$(D2) = A4 \cdot (\text{Time})^{B4}$$

$$C4 = A5 + (D2) \cdot B5$$

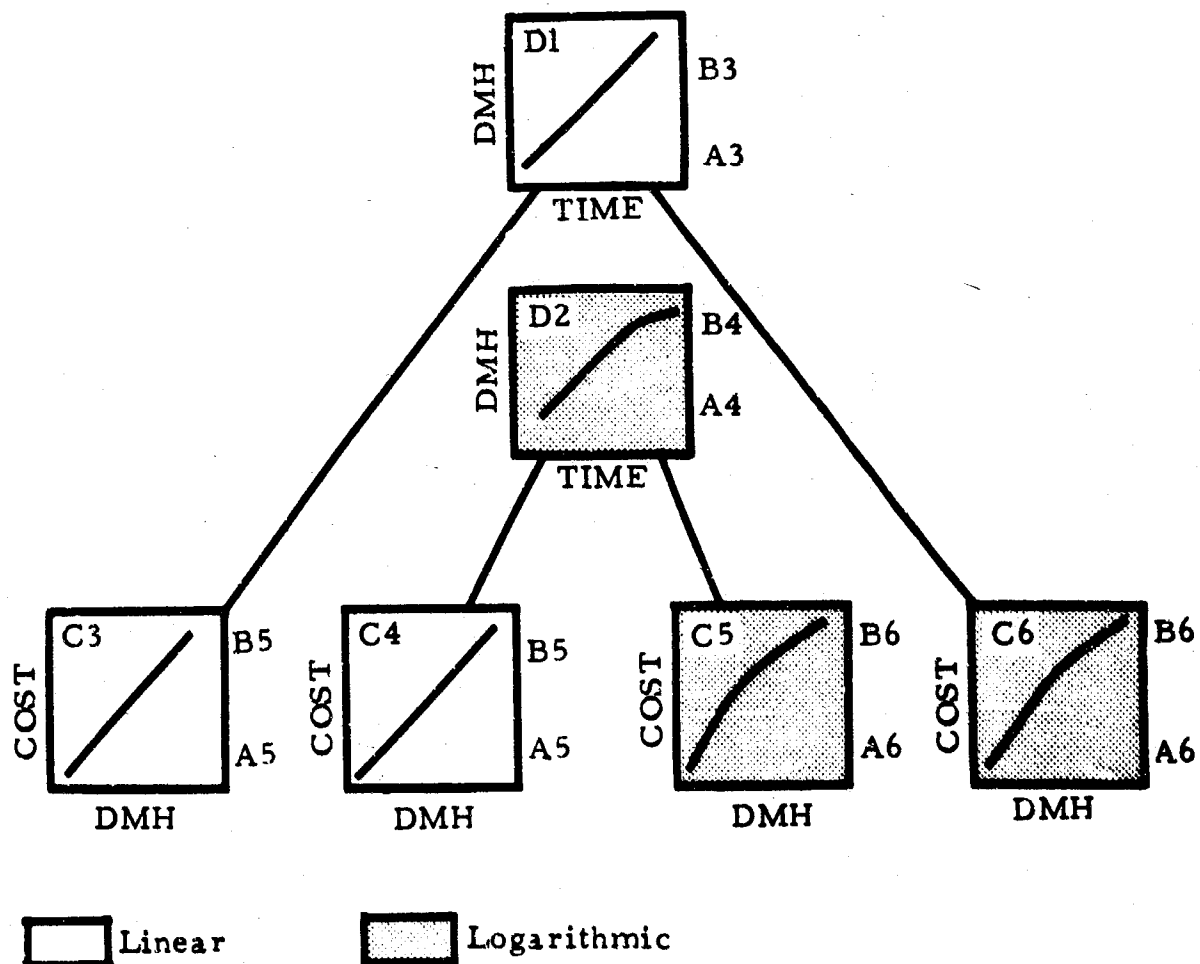
$$(D2) = A4 \cdot (\text{Time})^{B4}$$

$$C5 = A6 \cdot (D2)^{B6}$$

$$(D1) = A3 + \text{Time} \cdot B3$$

$$C6 = A6 \cdot (D1)^{B6}$$

(Time = Any Time Period Specified,
Most Commonly Some Future
Time Period)



MATHEMATICAL RELATIONSHIPS (CONTINUED)

DIRECT MANHOURS

$$D1 = A3 + Time \cdot B3$$

$$D2 = A4 \cdot (\text{Time})^{B4}$$

$$(C1) = A1 + (Time) \cdot B1$$

$$D3 = A7 + (C1) \cdot B7$$

$$(C2) = A2 \cdot (Time)^{B2}$$

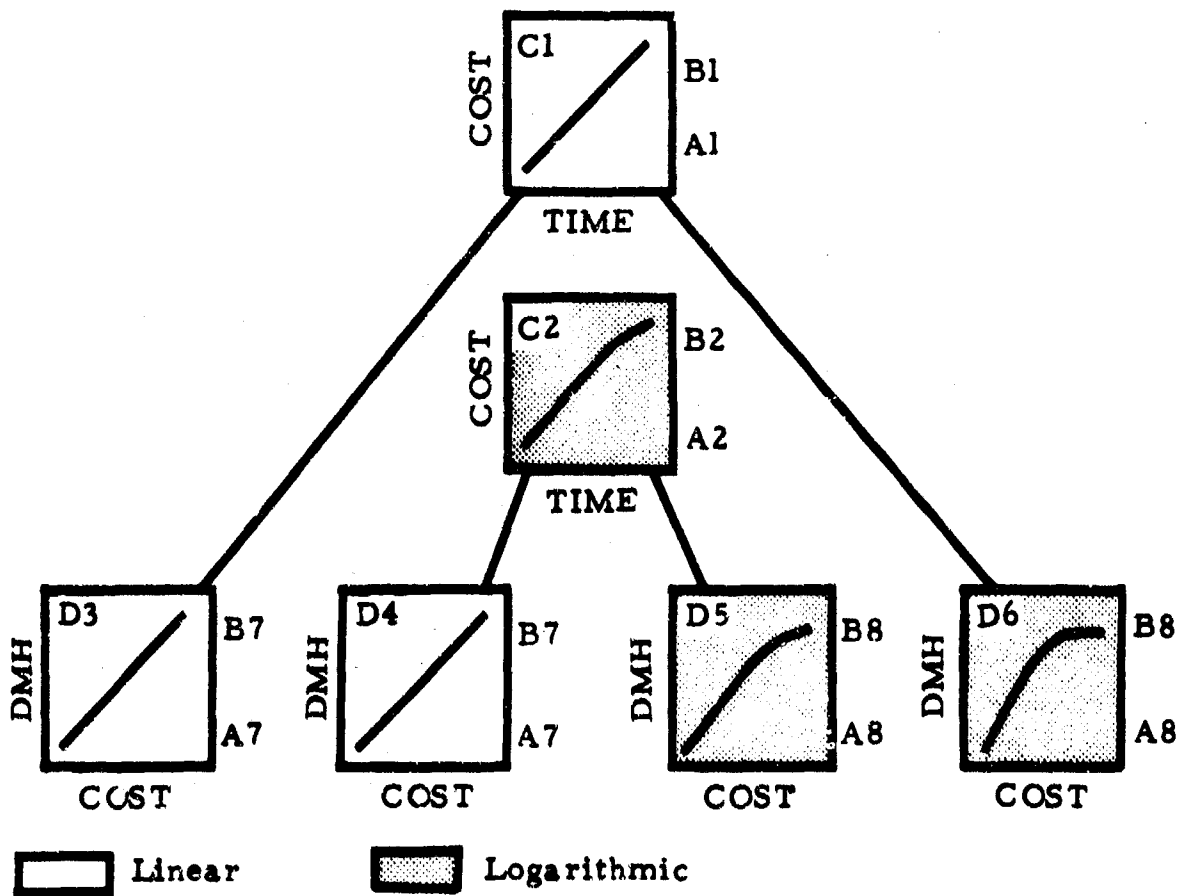
$$D4 = A7 + (C2) \cdot B7$$

$$(C2) = A2 \cdot (Time)^{B2}$$

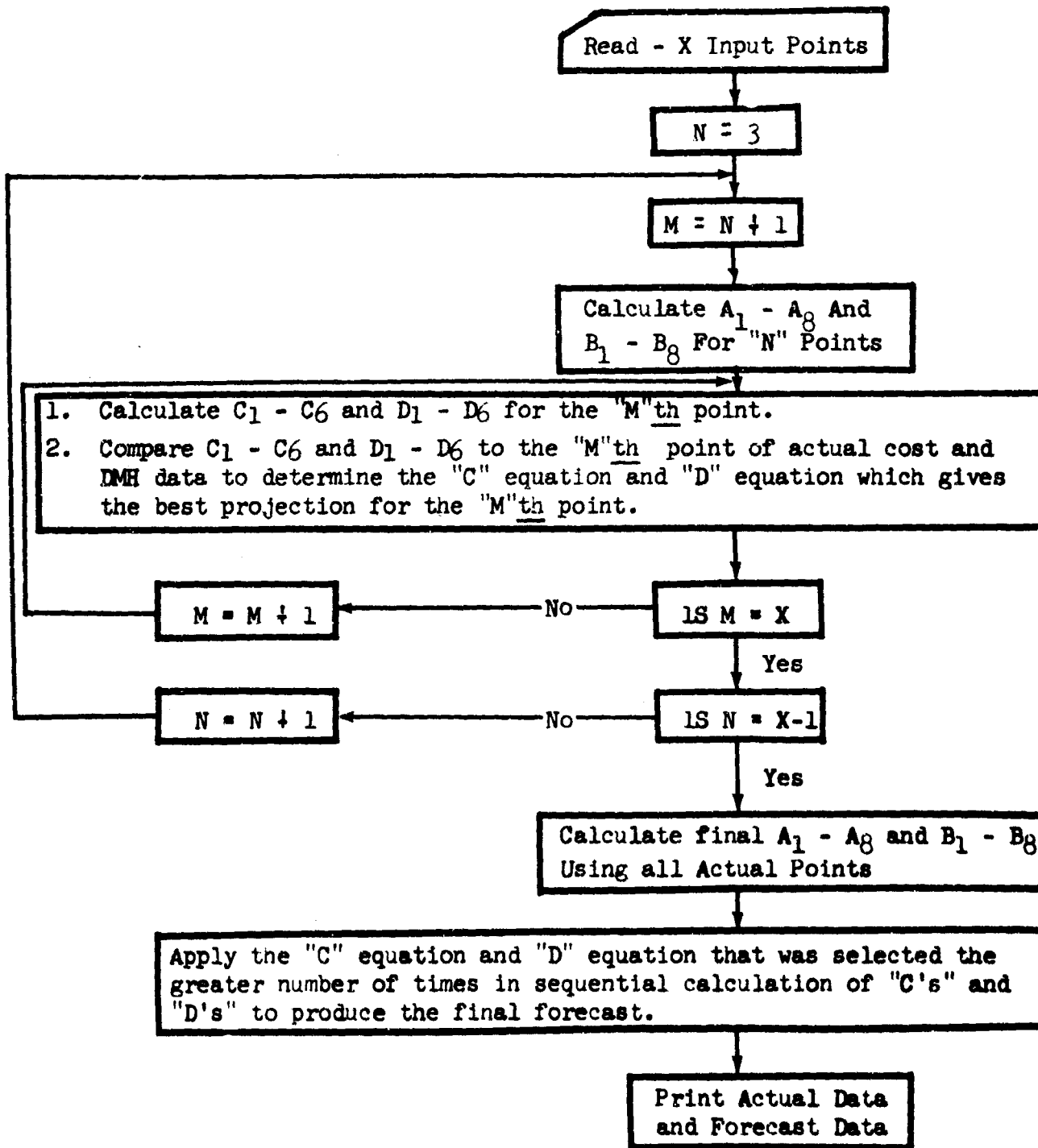
$$D5 = A8 \cdot (C2)^{B8}$$

$$(C1) = A1 + (Time) \cdot B1$$

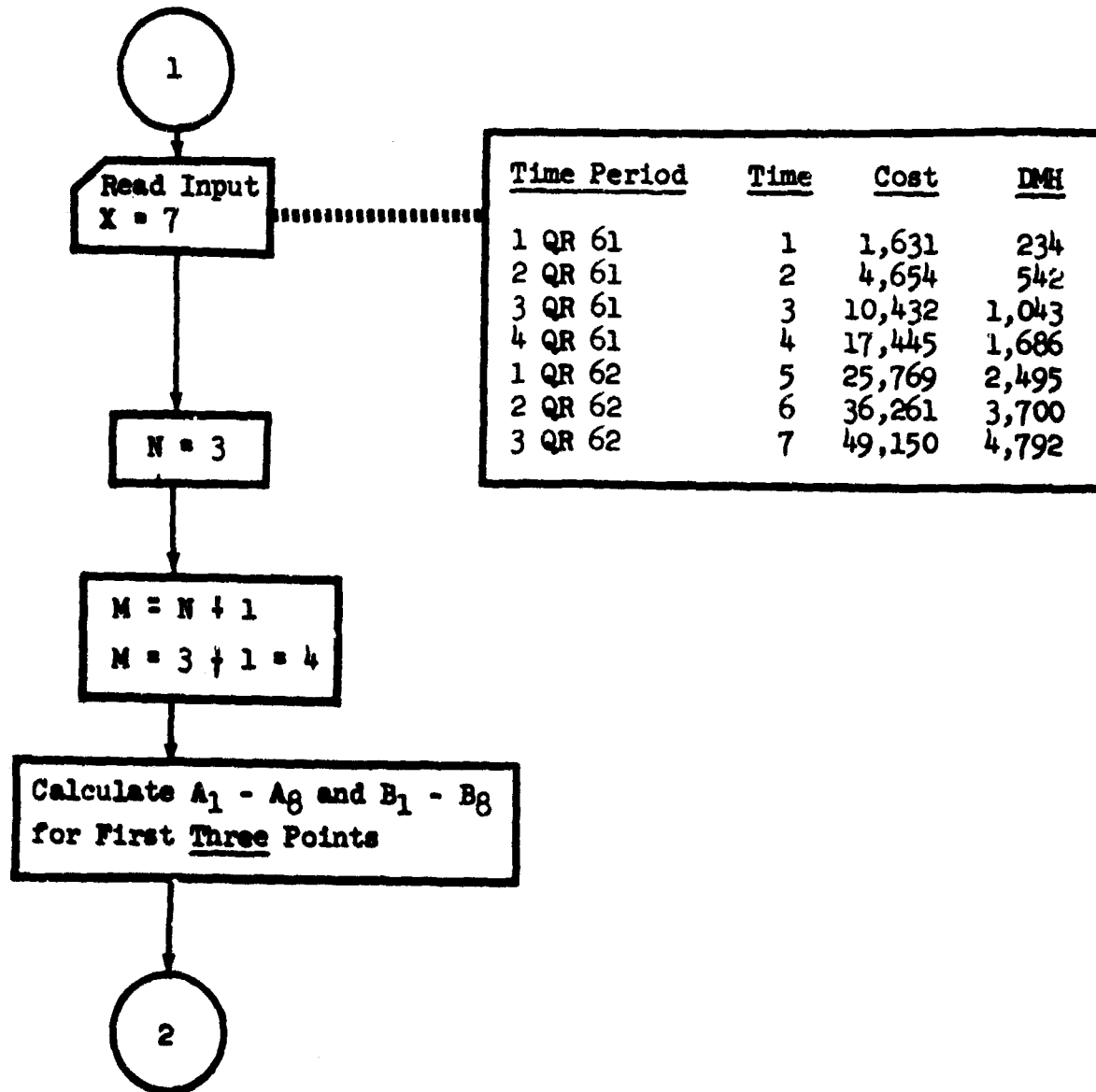
$$D6 = A8 \cdot (C1)^{B8}$$



GENERALIZED SCHEMATIC



DATA PROCESSING EXAMPLE



2

1. Calculate $C_1 - C_6$ and $D_1 - D_6$ for the Fourth point of actual cost and DMH Data.
2. Compare $C_1 - C_6$ and $D_1 - D_6$ to the Fourth point of actual cost and DMH data to determine the "C" equation and "D" equation which gives the best projection for the fourth point.

Cost = 17,445	DMH = 1,686
$C_1 = 14,833$	$D_1 = 1,443$
$C_2 = 16,508$	$D_2 = 1,488$
$C_3 = 14,869$	$D_3 = 1,439$
$C_4 = 15,380$	$D_4 = 1,588$
$C_5 = 16,477$	$D_5 = 1,490$
$C_6 = 15,839$	$D_6 = 1,369$

$$M = M + 1$$

$$M = 4 + 1 = 5$$

1. Calculate $C_1 - C_6$ and $D_1 - D_6$ for the Fifth point of actual cost and DMH data.
2. Compare $C_1 - C_6$ and $D_1 - D_6$ to the Fifth point of actual cost and DMH data to determine the "C" equation and "D" equation which gives the best projection for the fifth point.

Cost = 25,769	DMH = 2,495
$C_1 = 19,508$	$D_1 = 1,863$
$C_2 = 24,187$	$D_2 = 2,010$
$C_3 = 19,566$	$D_3 = 1,856$
$C_4 = 21,218$	$D_4 = 2,274$
$C_5 = 24,126$	$D_5 = 2,014$
$C_6 = 21,901$	$D_6 = 1,700$

$$M = M + 1$$

$$M = 5 + 1 = 6$$

1. Calculate $C_1 - C_6$ and $D_1 - D_6$ for the Sixth point of actual cost and DMH data.
2. Compare $C_1 - C_6$ and $D_1 - D_6$ to the Sixth point of actual cost and DMH data to determine the "C" equation and "D" equation which gives the best projection for the sixth point.

Cost = 36,261	DMH = 3,700
$C_1 = 24,184$	$D_1 = 2,283$
$C_2 = 33,046$	$D_2 = 2,570$
$C_3 = 24,264$	$D_3 = 2,274$
$C_4 = 27,478$	$D_4 = 3,065$
$C_5 = 32,945$	$D_5 = 2,575$
$C_6 = 28,345$	$D_6 = 2,013$

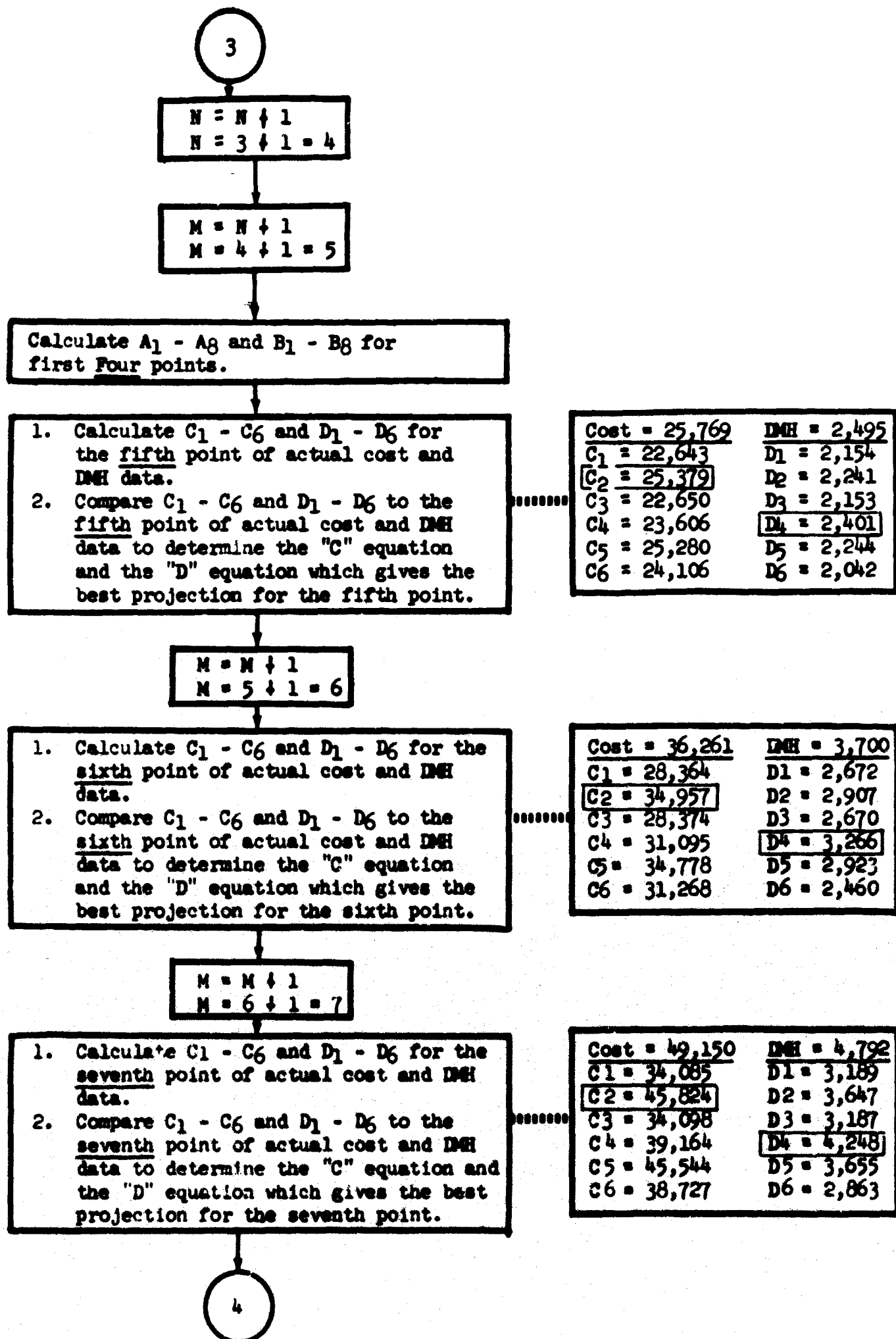
$$M = M + 1$$

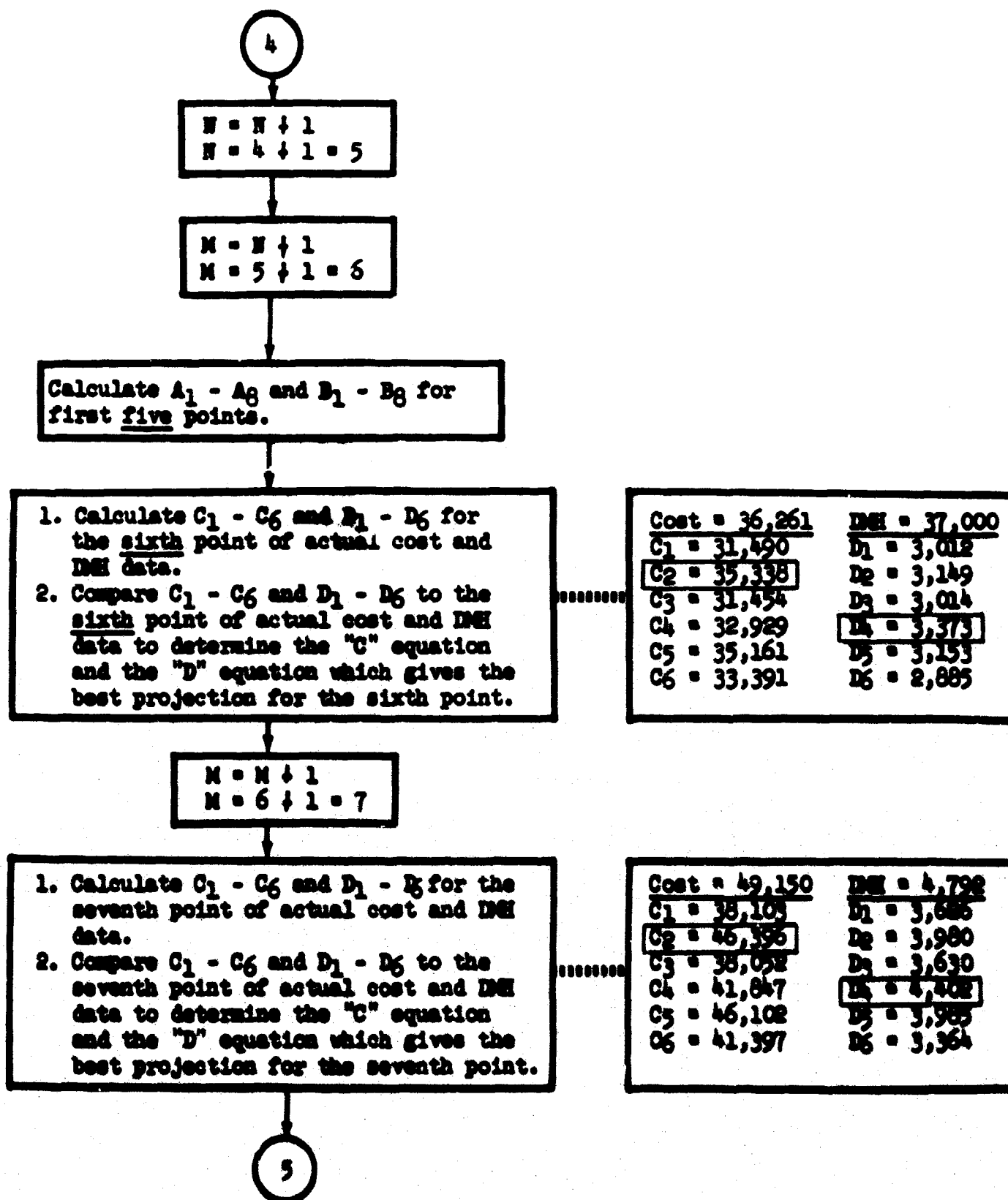
$$M = 6 + 1 = 7$$

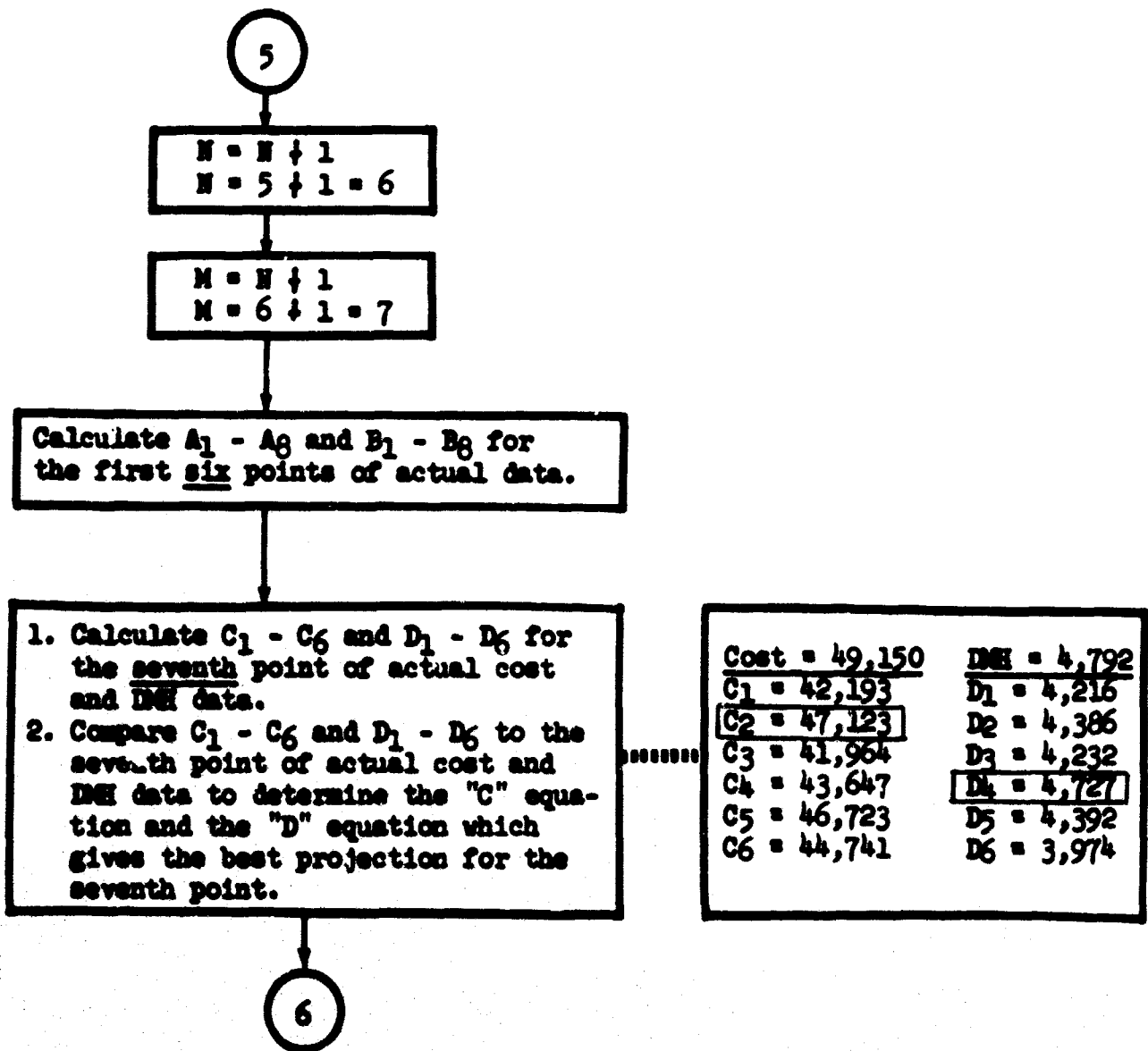
1. Calculate $C_1 - C_6$ and $D_1 - D_6$ for the Seventh point of actual cost and DMH data.
2. Compare $C_1 - C_6$ and $D_1 - D_6$ to the Seventh point of actual cost and DMH data to determine the "C" equation and "D" equation which gives the best projection for the seventh point.

Cost = 49,150	DMH = 4,792
$C_1 = 28,860$	$D_1 = 2,703$
$C_2 = 43,024$	$D_2 = 3,163$
$C_3 = 28,962$	$D_3 = 2,692$
$C_4 = 34,113$	$D_4 = 3,975$
$C_5 = 42,873$	$D_5 = 3,171$
$C_6 = 35,116$	$D_6 = 2,314$

3







6

Times "C" equation and "D" equation were selected

$C_1 = 0, C_2 = 10, C_3 = 0, C_4 = 0,$
 $C_5 = 0, C_6 = 0$
 $D_1 = 0, D_2 = 0, D_3 = 0, D_4 = 10,$
 $D_5 = 0, D_6 = 0$

Calculate final $A_1 - A_8$ and $B_1 - B_8$ using all seven points of actual data.

Apply the basic "C" equation and "D" equation that was selected the greater number of times in sequential calculation of "C's" and "D's", to produce the final forecast.

7

Forecast

<u>Date</u>	<u>Cost</u>	<u>DMH</u>
4 QR 62	62,213	6,067
1 QR 63	76,655	7,476
2 QR 63	92,444	9,017
3 QR 63	109,551	10,678
4 QR 63	127,952	12,482
1 QR 64	147,625	14,402
2 QR 64	168,550	16,444

7

Print
Output

CONTRACTOR'S NAME
MISSILE SYSTEM
R & D
TOTAL

-ACTUAL-

DATE	COST	DMH	\$/DMH	\$ CONTRACT VALUE
1 QR 61	\$ 1,631.	243.	6.71	.85
2 QR 61	4,654.	542.	8.58	2.44
3 QR 61	10,432.	1,043.	10.00	5.47
4 QR 61	17,445.	1,686.	10.35	9.14
1 QR 62	25,769.	2,495.	10.33	13.51
2 QR 62	36,261.	3,700.	9.80	19.01
3 QR 62	49,150.	4,792.	10.25	25.77

-FORECAST (ACE)-

3 QR 62	62,213.	6,067.	10.25	32.62
4 QR 62	76,655.	7,476.	10.25	40.19
1 QR 63	92,444.	9,017.	10.25	48.47
2 QR 63	109,551.	10,678.	10.25	57.44
3 QR 63	127,952.	12,482.	10.25	67.09
4 QR 63	147,625.	14,402.	10.25	77.40
1 QR 64	168,550.	16,444.	10.25	88.38

Contract Dollar Value \$190,707.

Underrun \$22,157. beginning 1 QR 64

If a comparison of previous forecasts is desired, the following output is available.

Percent Variance of Previous
Forecast from Subsequent Actual

Date	Cost	DMH
1 QR 62	- 5.47	- 5.81
2 QR 62	- 3.50	- 11.73
3 QR 62	- 6.77	- 11.35
2 QR 62	- 2.55	- 8.84
3 QR 62	- 5.00	- 8.14
3 QR 62	- 4.12	- 1.36

CHARACTERISTICS

- * Generally, the best dollar forecast is obtained by using a DMH-Time Base.
- * Generally, the best DMH forecast is obtained by using a Dollar-Time Base.
- * In many cases calculated forecast does not flatten out nearing the completion of a contract, as does the actual cost or DMH.
- * Trend values are adversely affected by erratic data - especially by negative input points.

RELIABILITY

GENERALLY

DMH ± 2% ERROR

DOLLARS ± 3-5% ERROR

The confidence level expressed here will be gradually improved as experience enables development of more sophisticated techniques. It has been proved that the present products are more valid than any currently available. Predicated on the assumption that the future data behavior will generally follow that of the actual, it is a positive fact that ACE forecasts will be extremely useful in making management decisions.

Improvements, refinements, and expansions are in development, and will be made available as rapidly as possible.

APPENDIX I

EXAMPLE OF ACE COMPUTER OUTPUT USING
CONTRACTOR DATA

CONTRACTOR
CONTRACT NUMBER
SYSTEM
FUNCTION

....ACTUAL....

DATE	COST	D.M.H.	\$/DMH
1 QR 61	1,631,795.	0 243,250.	6.71
2 QR 61	4,654,091.	0 542,600.	8.58
3 QR 61	10,432,464.	1,043,100.	10.00
4 QR 61	17,445,311.	1,686,100.	10.35
1 QR 62	25,769,096.	2,495,000.	10.33
2 QR 62	36,261,000.	3,700,000.	9.80
3 QR 62	49,150,000.	4,792,800.	10.25
4 QR 62	62,278,000.	5,965,683.	10.44
1 QR 63	75,685,000.	7,257,681.	10.43
2 QR 63	90,405,000.	8,713,017.	10.38
3 QR 63	108,227,000.	10,405,355.	10.40

2 4 WTD.

....FORECAST....

4 QR 63	126,613,116.	12,157,030.	10.41
1 QR 64	146,267,756.	14,029,536.	10.43
2 QR 64	167,170,013.	16,020,952.	10.43
3 QR 64	189,302,136.	18,129,527.	10.44
4 QR 64	212,647,683.	20,353,652.	10.45
1 QR 65	237,189,853.	22,691,840.	10.45
2 QR 65	262,914,458.	25,142,722.	10.46
3 QR 65	289,809,367.	27,705,009.	10.46
4 QR 65	317,860,199.	30,377,505.	10.46
1 QR 66	347,057,273.	33,159,083.	10.47
2 QR 66	377,387,809.	36,048,684.	10.47
3 QR 66	408,840,178.	39,045,308.	10.47
4 QR 66	441,407,879.	42,147,000.	10.47
1 QR 67	475,078,574.	45,355,869.	10.47

C 0 29 0 0 7 0
D 0 0 0 36 0 0

CONTRACTOR
CONTRACT NUMBER
SYSTEM
FUNCTION

....ACTUAL....

DATE	COST	D.M.H.	\$/DMH
1 QR 61	1,631,795.	0 243,250.	6.71
2 QR 61	4,654,091.	0 542,600.	8.58
3 QR 61	10,432,464.	1,043,100.	10.00
4 QR 61	17,445,311.	1,686,100.	10.35
1 QR 62	25,769,096.	2,495,000.	10.33
2 QR 62	36,261,000.	3,700,000.	9.80
3 QR 62	49,150,000.	4,792,800.	10.25
4 QR 62	62,278,000.	5,965,683.	10.44
1 QR 63	75,685,000.	7,257,681.	10.43
2 QR 63	90,405,000.	8,713,017.	10.38

2 4 WTD.

....FORECAST....

3 QR 63	107,524,586.	10,342,024.	10.40
	-0.65	-0.61	
4 QR 63	125,938,198.	12,094,164.	10.41
1 QR 64	145,623,775.	13,967,316.	10.43
2 QR 64	166,560,263.	15,959,566.	10.44
3 QR 64	188,730,389.	18,069,167.	10.44
4 QR 64	212,117,726.	20,294,517.	10.45
1 QR 65	236,704,487.	22,634,133.	10.46
2 QR 65	262,478,485.	25,086,647.	10.46
3 QR 65	289,425,495.	27,650,780.	10.47
4 QR 65	317,533,356.	30,325,332.	10.47
1 QR 66	346,789,382.	33,109,185.	10.47
2 QR 66	377,183,798.	36,001,282.	10.48
3 QR 66	408,703,972.	39,000,621.	10.48
4 QR 66	441,341,421.	42,106,258.	10.48
1 QR 67	475,087,794.	45,317,297.	10.48

C 0 24 0 0 4 0
D 0 0 0 28 0 0

CONTRACTOR
CONTRACT NUMBER
SYSTEM
FUNCTION

....ACTUAL....

DATE	COST	D.M.H.	\$/DMH
1 QR 61	1,631,795.	0 243,250.	6.71
2 QR 61	4,654,091.	0 542,600.	8.58
3 QR 61	10,432,464.	1,043,100.	10.00
4 QR 61	17,445,311.	1,686,100.	10.35
1 QR 62	25,769,096.	2,495,000.	10.33
2 QR 62	36,261,000.	3,700,000.	9.80
3 QR 62	49,150,000.	4,792,800.	10.25
4 QR 62	62,278,000.	5,965,683.	10.44
1 QR 63	75,685,000.	7,257,681.	10.43

2 4 WTD.

....FORECAST....

2 QR 63	91,625,906.	8,768,685.	10.45
	1.35	0.64	
3 QR 63	108,907,820.	10,406,800.	10.47
	0.63	0.01	
4 QR 63	127,506,238.	12,169,704.	10.48
1 QR 64	147,399,590.	14,055,313.	10.49
2 QR 64	168,566,387.	16,061,744.	10.49
3 QR 64	190,990,454.	18,187,279.	10.50
4 QR 64	214,654,461.	20,430,340.	10.51
1 QR 65	239,543,706.	22,789,466.	10.51
2 QR 65	265,642,104.	25,263,314.	10.51
3 QR 65	292,937,484.	27,850,617.	10.52
4 QR 65	321,418,539.	30,550,196.	10.52
1 QR 66	351,071,810.	33,360,948.	10.52
2 QR 66	381,886,550.	36,281,831.	10.53
3 QR 66	413,852,143.	39,311,854.	10.53
4 QR 66	446,960,137.	42,450,088.	10.53
1 QR 67	481,200,193.	45,695,645.	10.53

C 0 20 0 0 1 0
D 0 0 0 21 0 0

CONTRACTOR
CONTRACT NUMBER
SYSTEM
FUNCTION

....ACTUAL....

DATE	COST	D.M.H.	\$/DMH
1 QR 61	1,631,795.	0 243,250.	6.71
2 QR 61	4,654,091.	0 542,600.	8.58
3 QR 61	10,432,464.	1,043,100.	10.00
4 QR 61	17,445,311.	1,686,100.	10.35
1 QR 62	25,769,096.	2,495,000.	10.33
2 QR 62	36,261,000.	3,700,000.	9.80
3 QR 62	49,150,000.	4,792,800.	10.25
4 QR 62	62,278,000.	5,965,683.	10.44

2 4 WTD.

....FORECAST....

1 QR 63	76,907,661.	7,359,550.	10.45
	1.62	1.40	
2 QR 63	92,916,151.	8,884,788.	10.46
	2.78	1.97	
3 QR 63	110,276,034.	10,538,782.	10.46
	1.89	1.28	
4 QR 63	128,962,974.	12,319,214.	10.47
1 QR 64	148,955,558.	14,224,001.	10.47
2 QR 64	170,232,349.	16,251,261.	10.48
3 QR 64	192,777,862.	18,399,279.	10.48
4 QR 64	216,573,811.	20,666,476.	10.48
1 QR 65	241,605,535.	23,051,393.	10.48
2 QR 65	267,857,963.	25,552,681.	10.48
3 QR 65	295,318,740.	28,169,080.	10.48
4 QR 65	323,975,935.	30,899,407.	10.48
1 QR 66	353,816,173.	33,742,557.	10.49
2 QR 66	384,830,720.	36,697,490.	10.49
3 QR 66	417,007,978.	39,763,214.	10.49
4 QR 66	450,337,495.	42,938,797.	10.49
1 QR 67	484,811,946.	46,223,350.	10.49

C 0 15 0 0 0 0
D 0 0 0 15 0 0

CONTRACTOR
CONTRACT NUMBER
SYSTEM
FUNCTION

....ACTUAL....

DATE	COST	D.M.H.	\$/DMH
1 QR 61	1,631,795.	0 243,250.	6.71
2 QR 61	4,654,091.	0 542,600.	8.58
3 QR 61	10,432,464.	1,043,100.	10.00
4 QR 61	17,445,311.	1,686,100.	10.35
1 QR 62	25,769,096.	2,495,000.	10.33
2 QR 62	36,261,000.	3,700,000.	9.80
3 QR 62	49,150,000.	4,792,800.	10.25

2 4 WTD.

....FORECAST....

4 QR 62	62,213,492.	6,367,584.	10.25
	-0.10	1.71	
1 QR 63	76,655,565.	7,476,895.	10.25
	1.28	3.02	
2 QR 63	92,444,242.	9,017,612.	10.25
	2.26	3.50	
3 QR 63	109,551,587.	10,687,010.	10.25
	1.22	2.71	
4 QR 63	127,952,825.	12,482,670.	10.25
1 QR 64	147,625,859.	14,402,424.	10.25
2 QR 64	168,550,103.	16,444,313.	10.25
3 QR 64	190,707,994.	18,606,551.	10.25
4 QR 64	214,082,121.	20,887,497.	10.25
1 QR 65	238,657,715.	23,285,634.	10.25
2 QR 65	264,419,609.	25,799,564.	10.25
3 QR 65	291,354,542.	28,427,976.	10.25
4 QR 65	319,449,434.	31,169,645.	10.25
1 QR 66	348,694,541.	34,023,424.	10.25
2 QR 66	379,076,101.	36,988,235.	10.25
3 QR 66	410,585,480.	40,063,050.	10.25
4 QR 66	443,212,196.	43,246,900.	10.25
1 QR 67	476,947,915.	46,538,873.	10.25

C 0 10 0 0 0 0
D 0 0 0 10 0 0

CONTRACTOR
CONTRACT NUMBER
SYSTEM
FUNCTION

....ACTUAL....

DATE	COST	D.M.H.	\$/DMH
1 QR 61	1,631,795.	0 243,250.	6.71
2 QR 61	4,654,091.	0 542,600.	8.58
3 QR 61	10,432,464.	1,043,100.	10.00
4 QR 61	17,445,311.	1,686,100.	10.35
1 QR 62	25,769,096.	2,495,000.	10.33
2 QR 62	36,261,000.	3,700,000.	9.80

2 4 WTD.

....FORECAST....

3 QR 62	47,572,727.	4,837,438.	9.83
	-3.21	0.93	
4 QR 62	60,222,005.	6,109,373.	9.86
	-3.30	2.41	
1 QR 63	74,170,087.	7,511,907.	9.87
	-2.00	3.50	
2 QR 63	89,383,747.	9,041,700.	9.89
	-1.13	3.77	
3 QR 63	105,834,033.	10,695,840.	9.89
	-2.21	2.79	
4 QR 63	123,495,309.	12,471,751.	9.90
1 QR 64	142,344,323.	14,367,125.	9.91
2 QR 64	162,361,676.	16,379,883.	9.91
3 QR 64	183,526,295.	18,508,131.	9.92
4 QR 64	205,823,545.	20,750,131.	9.92
1 QR 65	229,234,455.	23,104,281.	9.92
2 QR 65	253,747,683.	25,569,104.	9.92
3 QR 65	279,346,674.	28,143,217.	9.93
4 QR 65	306,020,022.	30,825,331.	9.93
1 QR 66	333,755,885.	33,614,239.	9.93
2 QR 66	362,541,438.	36,508,805.	9.93
3 QR 66	392,368,001.	39,507,951.	9.93
4 QR 66	423,224,054.	42,610,664.	9.93
1 QR 67	455,100,217.	45,815,986.	9.93

C 0 6 0 0 0 0
D 0 0 0 0 6 0 0

CONTRACTOR
CONTRACT NUMBER
SYSTEM
FUNCTION

....ACTUAL....

DATE	COST	D.M.H.	\$/DMH
1 QR 61	1,631,795.	0 243,250.	6.71
2 QR 61	4,654,091.	0 542,600.	8.58
3 QR 61	10,432,464.	1,043,100.	10.00
4 QR 61	17,445,311.	1,686,100.	10.35
1 QR 62	25,769,096.	2,495,000.	10.33

2 4 WTD.

....FORECAST....

2 QR 62	35,498,218.	3,400,573.	10.44
	-2.10	-8.09	
3 QR 62	46,556,587.	4,429,870.	10.51
	-5.28	-7.57	
4 QR 62	58,896,929.	5,578,491.	10.56
	-5.43	-6.49	
1 QR 63	72,479,683.	6,842,754.	10.59
	-4.24	-5.72	
2 QR 63	87,271,004.	8,219,509.	10.62
	-3.47	-5.66	
3 QR 63	103,241,426.	9,706,013.	10.64
	-4.61	-6.72	
4 QR 63	120,364,913.	11,299,842.	10.65
1 QR 64	138,618,096.	12,998,831.	10.66
2 QR 64	157,980,148.	14,801,028.	10.67
3 QR 64	178,432,094.	16,704,660.	10.68
4 QR 64	199,956,186.	18,708,100.	10.69
1 QR 65	222,536,377.	20,809,849.	10.69
2 QR 65	246,158,260.	23,008,529.	10.70
3 QR 65	270,807,952.	25,302,849.	10.70
4 QR 65	296,471,916.	27,691,604.	10.71
1 QR 66	323,138,509.	30,173,671.	10.71
2 QR 66	350,795,890.	32,747,994.	10.71
3 QR 66	379,433,369.	35,413,569.	10.71
4 QR 66	409,041,402.	38,169,451.	10.72
1 QR 67	439,610,607.	41,014,753.	10.72

C 0 3 0 0 0 0
D 0 0 0 0 3 0 0

CONTRACTOR
 CONTRACT NUMBER
 SYSTEM
 FUNCTION

....ACTUAL....

DATE	COST	D.P.H.	\$/DMH
1 QR 61	1,631,795.	0 243,250.	6.71
2 QR 61	4,654,091.	0 542,600.	8.58
3 QR 61	10,432,464.	1,043,100.	10.00
4 QR 61	17,445,311.	1,686,100.	10.35

2 4 WTD.

....FORECAST....

1 QR 62	25,673,453.	2,429,439.	10.57
	-0.37	-2.63	
2 QR 62	35,250,938.	3,294,679.	10.70
	-2.79	-10.95	
3 QR 62	46,118,665.	4,276,481.	10.78
	-6.17	-10.77	
4 QR 62	58,228,806.	5,370,524.	10.84
	-6.50	-9.98	
1 QR 63	71,541,394.	6,573,198.	10.88
	-5.47	-9.43	
2 QR 63	86,022,274.	7,881,416.	10.91
	-4.85	-9.54	
3 QR 63	101,641,754.	9,292,496.	10.94
	-6.08	-10.70	
4 QR 63	118,373,628.	10,804,072.	10.96
1 QR 64	136,194,238.	12,414,026.	10.97
2 QR 64	155,083,615.	13,120,456.	10.98
3 QR 64	175,020,387.	15,921,635.	10.99
4 QR 64	195,989,767.	17,815,975.	11.00
1 QR 65	217,973,702.	19,852,021.	11.01
2 QR 65	240,957,756.	21,878,430.	11.01
3 QR 65	264,927,989.	24,043,948.	11.02
4 QR 65	289,871,958.	26,297,402.	11.02
1 QR 66	315,777,259.	28,637,706.	11.03
2 QR 66	342,632,254.	31,063,831.	11.03
3 QR 66	370,426,644.	33,574,803.	11.03
4 QR 66	399,150,502.	36,169,709.	11.04
1 QR 67	428,792,240.	38,847,684.	11.04

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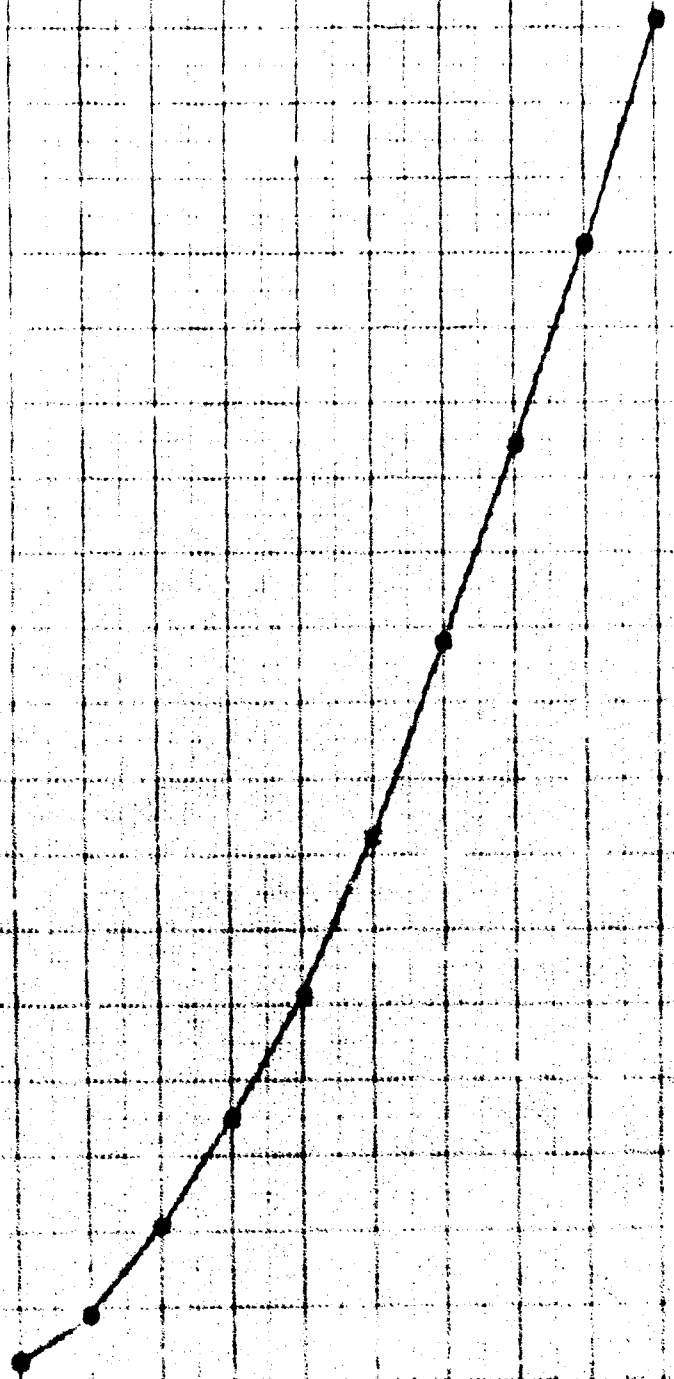
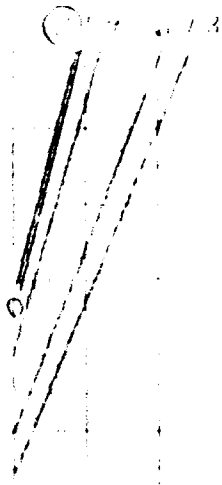
APPENDIX II

Graphical representation of the cost forecasts illustrated in Appendix I.

The graphs depict the six cost forecast with the selected cost forecast circled.

LEGEND:

- Actual cost data used to make forecast
- ACE cost forecasts based upon actual data.
- Subsequent actual cost data

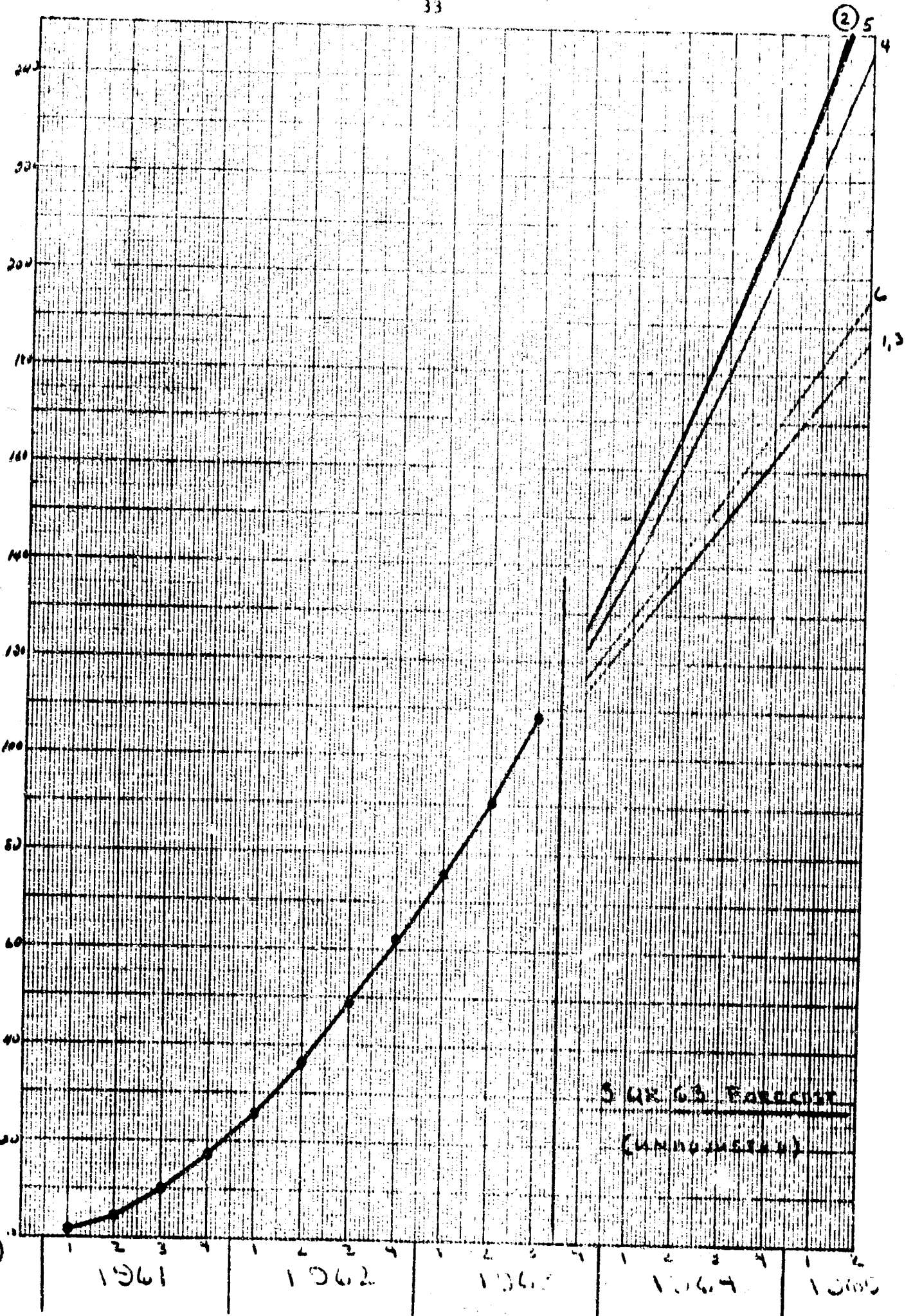


2 QK 63 Forecast
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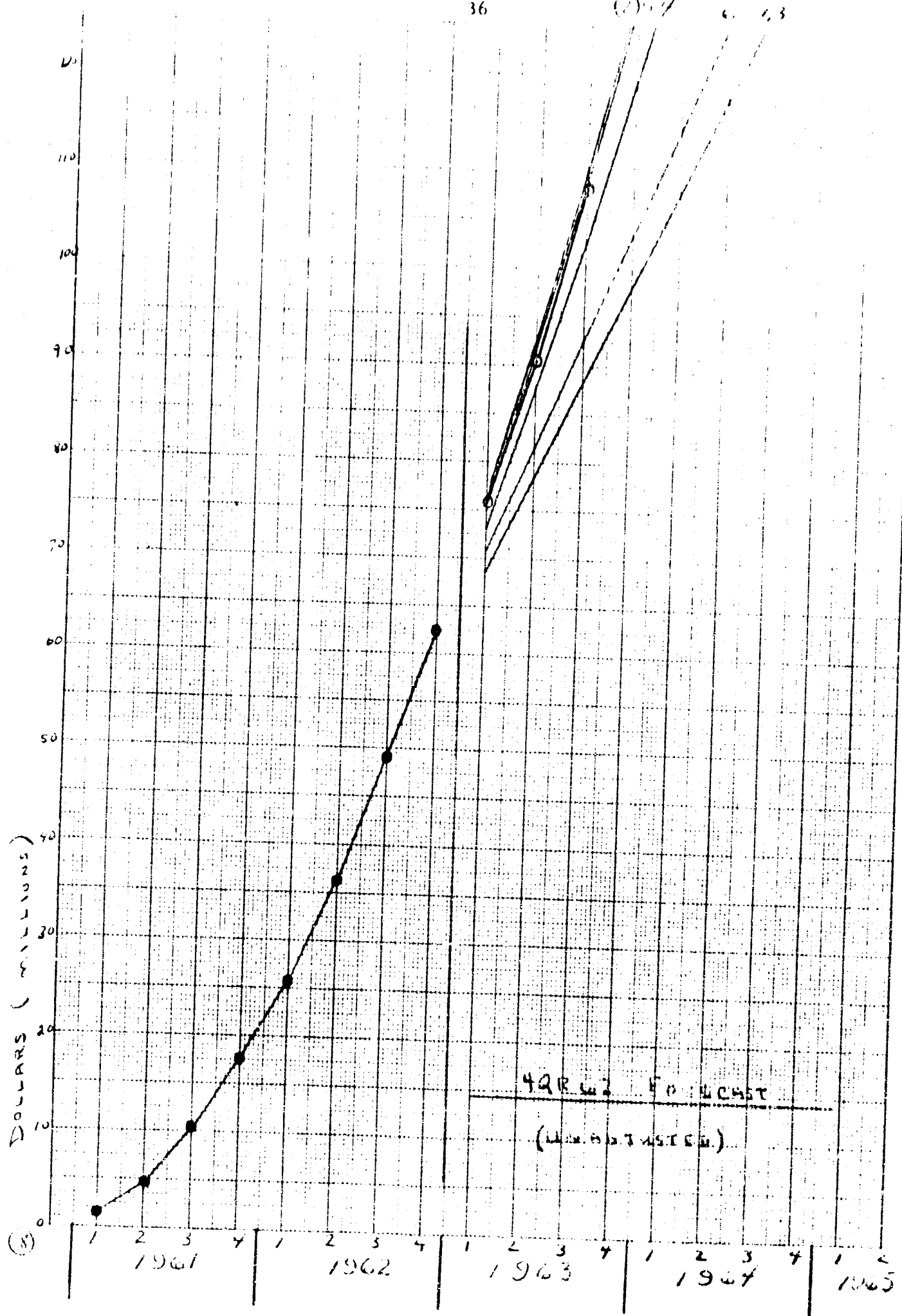
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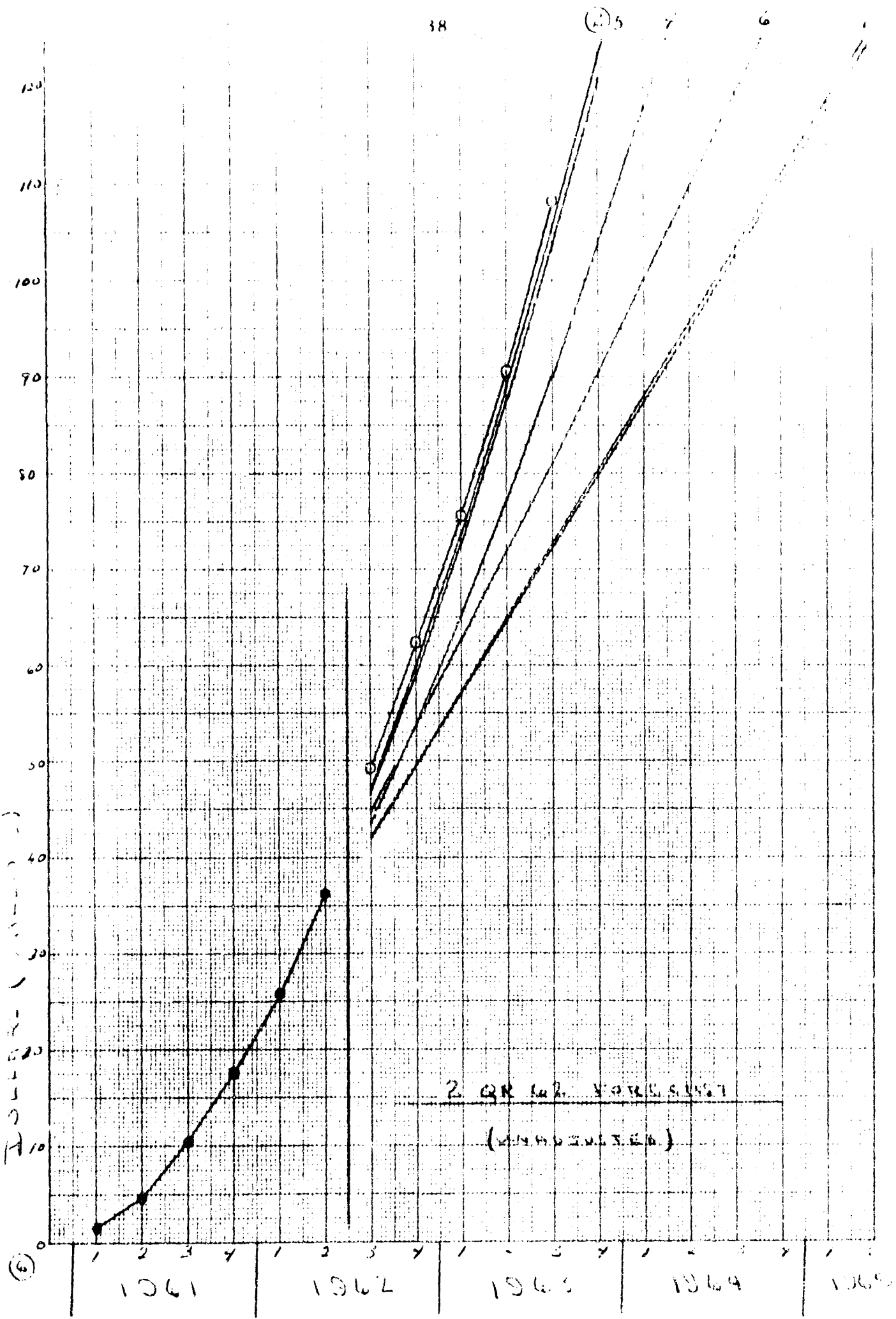
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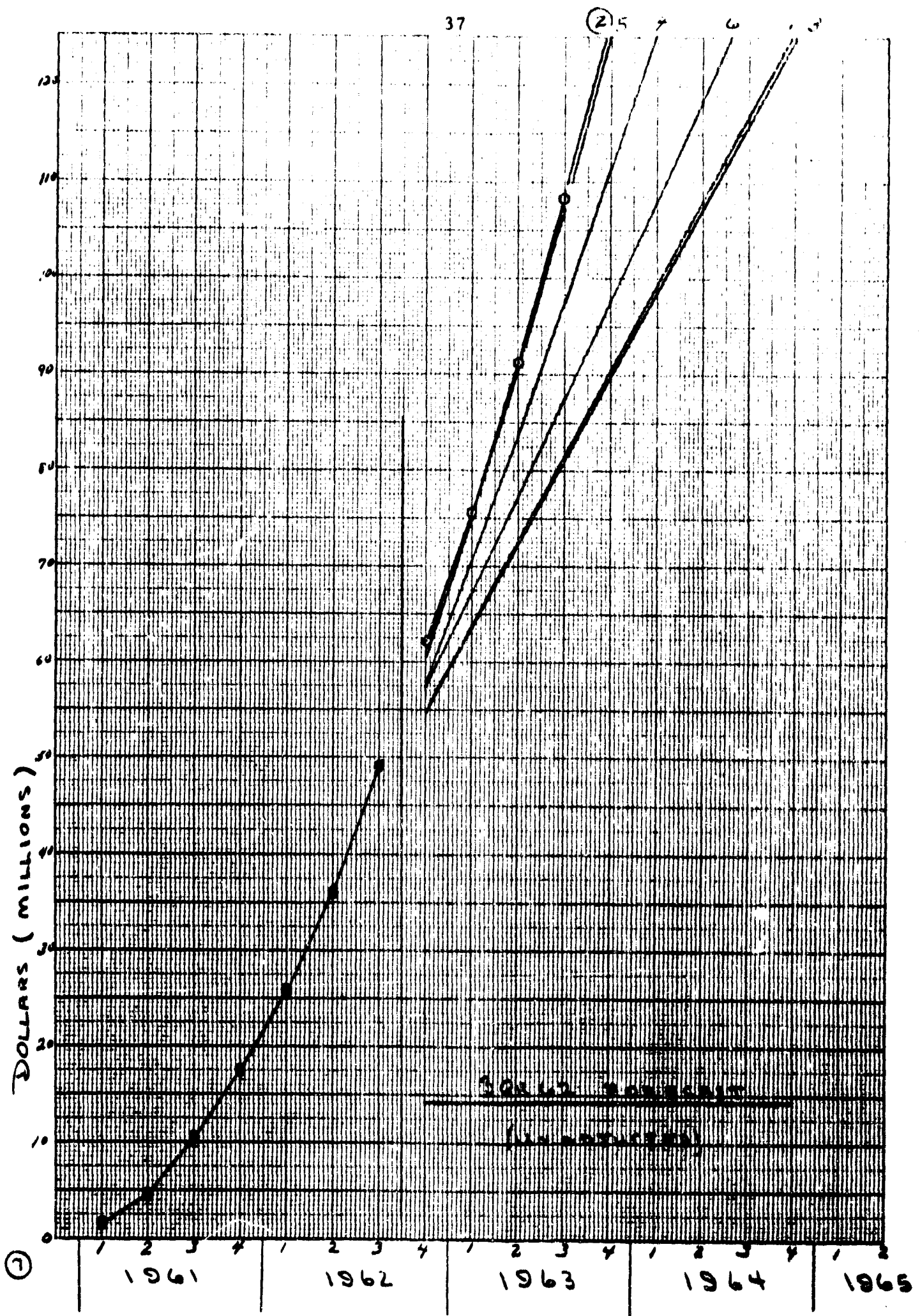
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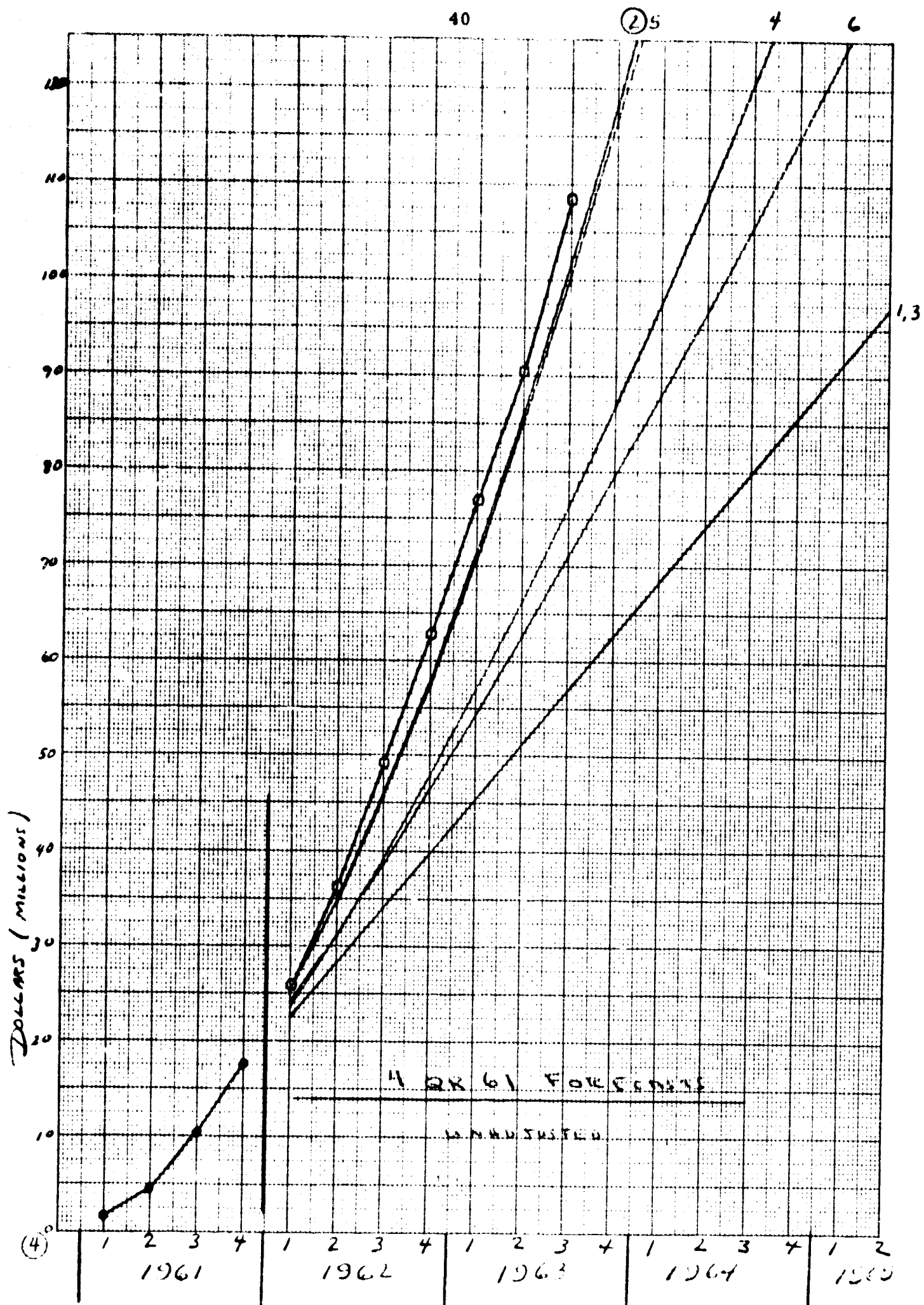


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K-E 10 X 10 TO THE CM. 358-14
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REF ID: A61070 THE CM 35814
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DOLLARS (MILLIONS)

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