

I hereby certify that this land surveying document was prepared by me or under my direct personal supervision and that I am a duly Registered Land Surveyor under the laws of the State of Iowa.

Signature _____

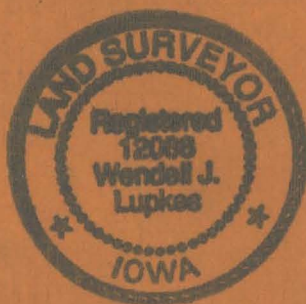
Wendell J. Lupkes

Date _____ Reg. No. 12088

My registration expires December 31, _____



Field Book
E 64-8x4 S



50% cotton-content paper
water resistant surface
32 sheets . . . 4 $\frac{5}{8}$ " x 7 $\frac{1}{4}$ "

CURVE FORMULAS

$$T = R \tan \frac{1}{2} I$$

$$T = \frac{50 \tan \frac{1}{2} I}{\sin \frac{1}{2} D}$$

$$\sin \frac{1}{2} D = \frac{50}{R}$$

$$\sin \frac{1}{2} D = \frac{50 \tan \frac{1}{2} I}{T}$$

$$R = T \cot \frac{1}{2} I$$

$$R = \frac{50}{\sin \frac{1}{2} D}$$

$$E = R \text{ ex. sec } \frac{1}{2} I$$

$$E = T \tan \frac{1}{2} I$$

$$\text{Chord def.} = \frac{\text{chord}^2}{R}$$

$$\text{No. chords} = \frac{I}{D}$$

$$\text{Tan. def.} = \frac{1}{2} \text{ chord def.}$$

The square of any distance, divided by twice the radius, will equal the distance from tangent to curve, very nearly.

To find angle for a given distance and deflection.

Rule 1. Multiply the given distance by .01745 (def. for 1° for 1 ft.) and divide given deflection by the product.

Rule 2. Multiply given deflection by 57.3, and divide the product by the given distance.

To find deflection for a given angle and distance. Multiply the angle by .01745, and the product by the distance.

GENERAL DATA

RIGHT ANGLE TRIANGLES. Square the altitude, divide by twice the base. Add quotient to base for hypotenuse.

Given Base 100, Alt. 10. $10^2 \div 200 = .5$. $100 + .5 = 100.5$ hyp.

Given Hyp. 100, Alt. $25.25^2 \div 200 = 3.125$. $100 - 3.125 = 96.875 = \text{Base}$.

Error in first example, .002; in last, .045.

To find Tons of Rail in one mile of track: multiply weight per yard by 11, and divide by 7.

LEVELING. The correction for curvature and refraction, in feet and decimals of feet is equal to $0.574 d^2$, where d is the distance in miles. The correction for curvature alone is closely, $\frac{1}{2} d^2$. The combined correction is negative.

PROBABLE ERROR. If d_1, d_2, d_3 , etc. are the discrepancies of various results from the mean, and if $\sum d^2$ = the sum of the squares of these differences and n = the number of observations, then the probable error of the mean = $\pm 0.6745 \sqrt{\frac{\sum d^2}{n(n-1)}}$

MINUTES IN DECIMALS OF A DEGREE

1'	.0167	11'	.1833	21'	.3500	31'	.5167	41'	.6833	51'	.8500
2	.0333	12	.2000	22	.3667	32	.5333	42	.7000	52	.8667
3	.0500	13	.2167	23	.3833	33	.5500	43	.7167	53	.8833
4	.0667	14	.2333	24	.4000	34	.5667	44	.7333	54	.9000
5	.0833	15	.2500	25	.4167	35	.5833	45	.7500	55	.9167
6	.1000	16	.2667	26	.4333	36	.6000	46	.7667	56	.9333
7	.1167	17	.2833	27	.4500	37	.6167	47	.7833	57	.9500
8	.1333	18	.3000	28	.4667	38	.6333	48	.8000	58	.9667
9	.1500	19	.3167	29	.4833	39	.6500	49	.8167	59	.9833
10	.1667	20	.3333	30	.5000	40	.6667	50	.8333	60	1.0000

INCHES IN DECIMALS OF A FOOT

1-16	3-32	$\frac{1}{8}$	3-16	$\frac{1}{4}$	5-16	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$
.0052	.0078	.0104	.0156	.0208	.0260	.0313	.0417	.0521	.0625	.0729
1	2	3	4	5	6	7	8	9	10	11
.0833	.1667	.2500	.3333	.4167	.5000	.5833	.6667	.7500	.8333	.9167

PROPERTY OF BLACK HAWK
COUNTY Engineer's Office
316 E. 5th St., Ste 211
Waterloo, IA 50703
(319) 291-2419

Wendell Lupkes, L.S.

Log of working activities
and business conversations &
agreements.

April 1993 -

Date	Name	Representing	Phone	Remarks
4-27-93	Ken Shuey	I.D.O.T Vehicles	⁵¹⁵ 239-1413	He getting in pickups for June auction, we may inspect soon.
"	Jim	LaPorte Telephone	³¹⁹ 342-2213	Told me cable is on west side Canfield @ Indian Cr.
"	Scott	Farmers Tele. Jesup		Located " on East " " " " "
"	John Hagar	Himself	³¹⁹ 342-3112	Reported missing section corner N $\frac{1}{4}$ 23-87-12
4-30-93	Tom Line	U.S. West	291-9315	Need R.O.W located E. side Union S. of Mark for
	(Howard Kank)	Kiewit Technologies	³¹⁹ 342-3722	Fibre optic cable pedestal than may encroach
4-30-93	Terry VanLangingham	LS		Can't find E $\frac{1}{4}$ 5-90-12 will meet there 1:00 Tues.
"	Lynn Pedderson	H.I.T. Student		Notified her of being selected for summer employment
5-3-93	Kermitt Allord	(Union Rd Fibre Optic)	266-1860	
" " "	Tom Lines	US West	291-9315	Informed him as to location of Fibre optic
" " "	Howard Kank	Kiewit Technologies	³¹⁹ 342-3722	pedestal on Union Rd. South of Mark Rd (51.2')
" " "	Ken Shuey	I.D.O.T.		Called about pickups on May D.O.T. auction
5-12-93	Ervin Jacobsen	Land Owner	³¹⁹ 342-2590	Called # about resetting N $\frac{1}{4}$ 23-87-12 N.A.

7-7-93 Took ditch shots for drive on Hammond Rd (West side) North of Eagle. Mrs. Putney property, requested by Earl Stienel. Set both 353' North of E Eagle and talked with Earl Stienel at the site. He will be sending completed appt. with Mrs Putney's signature. Sight distance North = 2000' +. Sight distance South = 1100'. Dry Fill

7-8-93 Talked with Vern Lühring, he was willing to allow Hershberger to park dozer on his property for the July 10th weekend. Call Hershberger and informed them and told them Jepsen road was not embargoed. Called Northern-Natural and told them we will start tiling Monday.

7-9-93 Called Cedar Falls utilities and informed them we will begin work on 12th St. Monday. Northern Natural 296-2141 Kevin Graves
C.F. Utilities 266-1761 Ext 341 or 363
Gordon or Dan
U.S. West. Ken 1-515-221-7208
Ken with U.S. West will locate cable routes and drops this weekend.

7-8-93 Met with Tim Staley, County Relief at Shaulis cemetery. Discussed problem with Brad at ASPRO. He will call Tim Staley with price to asphalt existing drive.

7-12-93 12th St. Tiling - Set out Road Const. AHEAD SIGNS @ Both ends of job. U.S. West has located lines and drops to houses. We will have 3 locations where telephone crosses 12th St., 1 location where C.F. utilities crosses, and 1 location where Northern Natural Gas crosses 12th St.

- HERSHBERGER BEGAN TILING @ STA
@ APPROX. 9:00 AM. PLACED ' PNC. OUTLET
WITH RODENT GUARDS @ 20' EAST OF
EXISTING CULVERT. PULLED RIGHT SIDE TO
PHONE SERVICE TO HOUSE @ STA
BACKED UP AND PULLED LEFT SIDE TO SAME
PHONE SERVICE. UNCOVERED TWO WIRES
ACROSS ROAD - BROKE ONE, BUT PHONES WERE
STILL WORKING IN HOUSE. PULLED RIGHT
SIDE TO STA. AND CAPPED END. PULLED
LEFT SIDE TO END AT SAME STA BUT HIT
WHAT APPEARED TO BE AN ABANDONED PHONE

(CONT.) CABLE. PULLED OUT SECTION APPROX. 30' LONG. PHONE REP. WAS CALLED WHEN FIRST PHONE SERV. LINE WAS BROKEN.

- PROCEEDED TO DIG OUTLET W. OF CULVERT 20' AND PULLED TILE IN ONE LEFT SIDE TO STA WHERE C.F. UTIL. HAD MARKED UNDERGROUND ELECT. LINE (THEY TOLD HERSHBERGER IT "SHOULD BE 60" DEEP," BUT WE'LL HAND DIG IT TO BE SAFE.)

PULLED LEFT SIDE TO STA AND FOUND DEPTH TO BE DECREASING TO 2' 9". PULLED RIGHT SIDE TO STA TO MATCH LEFT.

7-12-93 PLACED OUTLETS @ STA

AND PULLED SIDE TO STA
PULLED SIDE TO STA

4:00 pm Tiling co. cut phone service line to 12th ST. US west sliced line and located same line on S. side of road. Hit old 5" approx. clay tile @ W. edge of house @ 12th ST. Connected tile w/ 4" plastic tee @ STA. 4" line on left & right were pulled to STA. Lines were plugged short of telephone drop.

7-13-93 7:30 am exposed telephone drop @ STA 26+25 left. pulled left tile to STA. Exposed telephone drop on right side & pulled to STA.

Mrs. Van Hoven called & said no phone service called U.S. West, & said they would be out today or tomorrow. Stopped due to rain.

7-13-93 2:00PM WEATHER CLEARED

DUG OUTLETS @ STA 0+50 RT & LT

CROSSED GAS PIPELINE @ 2:31 PM

Begin @ Sta. 0+12 approx. 7' S. of Shoulder
of road on left side (W).

Stopped @ Sta. 23+70 @ 3:00pm. Tile crew
pulled out some old phone cable,

Begin @ Sta. 0+12 approx. 7' N. of Shoulder

tile was placed, on Right side (S.) @ 3:20 pm.

Crossed gas Line @ 3:30 pm, From Sta. 5+90
to 10+35 tile was 9' from shoulder, from Sta
10+35 to 23+70 tile was placed @ 7' from
shoulder. Tiling stopped @ Sta. 23+70.

No phone lines were crossed. One gas
Line was crossed twice. Road closed signs
were placed @ Both Ends, Finished @ 4:30 pm.

July 14, 1993

Talked with line crew from LEMEYER
ELECTRIC CONTR. of Marshalltown. They said
they thought the company would send cat
with blade up to clean up torn up areas
along Dubuque Rd. They'll be stringing
new line to Jessup. Gave them my card

July 20, 1993

Talked with OK Collins of U.S.
West who is the contract work
inspector and he said PUSH INC
had left the area but knew they had
a lot of cleanup to do. I asked him to
call me when they return and told him
we plan to do emergency repairs only.

Talked with Andy @ Carlson (319-382-4249)
He said State will be having Aspro resurf.
Cedar-Wapsi from Old to New 218. They
would like us to move light back @
SE quad. intersection. Aspro may be
starting next week.

School Bus Stop Ahead

10509 Dubuque

Talked with Harold P. on 9-22-15

Target Ht = 4.0

Drivers Eye = 3.5

Length of sight triangle = 100'

Sight Distance West = 960'

Sight Distance East = 1840'

School Bus Stop AHEAD

50835 Jesup

Target Height $\approx 4.0'$

Drivers Eye $= 3.5'$

Sight Distance South = 3000' +

Sight Distance North = 3000' +

STA	BS	HI	FS	ELEV
266+00			8.01	851.80 851.82
267+00			7.16	852.65 852.68
268+00			5.78	854.03 854.09
Pno 20			5.38	854.43 854.53
Top Step			2.412	857.39 857.70
Middle Step			3.08	856.73
Bottom Step			3.741	856.07
269+00	4.34	859.81		855.47

STA	BS	HI	FS	ELEV	
				851.08	
TBM		5.71	851.06		PAINT MARK ON TOP PRECAST CONCRETE PUMP HOUSING 85 FEET SW OF BRIDGE
				851.80	
266+00		5.05	851.77	851.82	& PAVEMENT
				850.00	
PNO 19		6.85	849.97	850.12	NAIL in FLD ENT LEFT STA 263+55±
				852.89	
BM		3.96	852.86		R.R. SPIKE IN POWER POLE 250 ± NE OF BRIDGE
				851.56	
265+00	5.29	856.82	851.53		& PAVEMENT

$$F = 1 \frac{83}{93}$$

53.45 Plan Sho

55.162 Top Rail

5.92

(53.79) Hub

54.10

conc

5.61

(54.10)

HI = 59.71

$$F = 1 \frac{62}{62}$$

Plan Sho 53.45

Top Rail 55.162

5.71

Hub (54.00)

$$F = 1 \frac{96}{96}$$

57.59 Top Rail

55.42 Plan Sho.

4.20

Hub (55.63)

HI = 59.83

(56.07)

3.76

56.07
conc

$$F = 2 \frac{17}{17}$$

Top Rail 57.59

Plan Sho. 55.42

4.11

Hub (55.42)

Valley High Borrow Bench Run

BM		6.04	908.22	908.81	NW Bolt FH @ Valley High & Cardinal
TP 1	0.10	914.26	18.78	914.16	
TP 3	1.04	932.94	12.81	931.90	FLAT 10' N of TP 2
TBM		6.52			"X" cut in Paint @ SE Cor PROPERTY
BM	1.55	944.71	1.71	943.16	NW Bolt FH @ SE Cor 4044
TP 2	12.35	944.87	0.37	932.52	Flat next to rock @ SE Cor Borrow
TP 1	18.41	932.89	0.02	914.75	Flat on S. Slope borrow
BM	5.96	914.77		908.81	NW Bolt FH @ Valley High & Cardinal

Tama Rd. Rubblizing

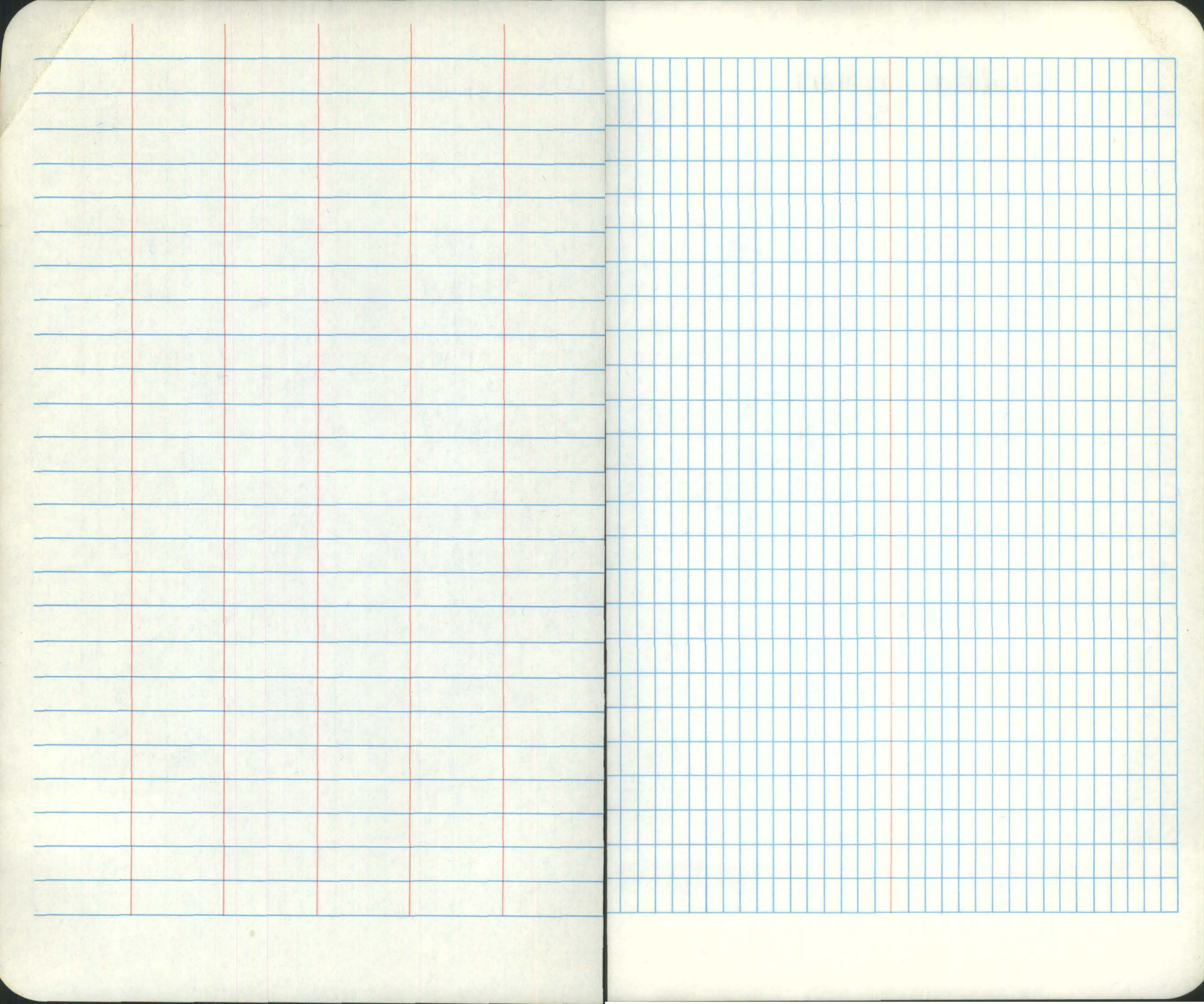
7-28-95

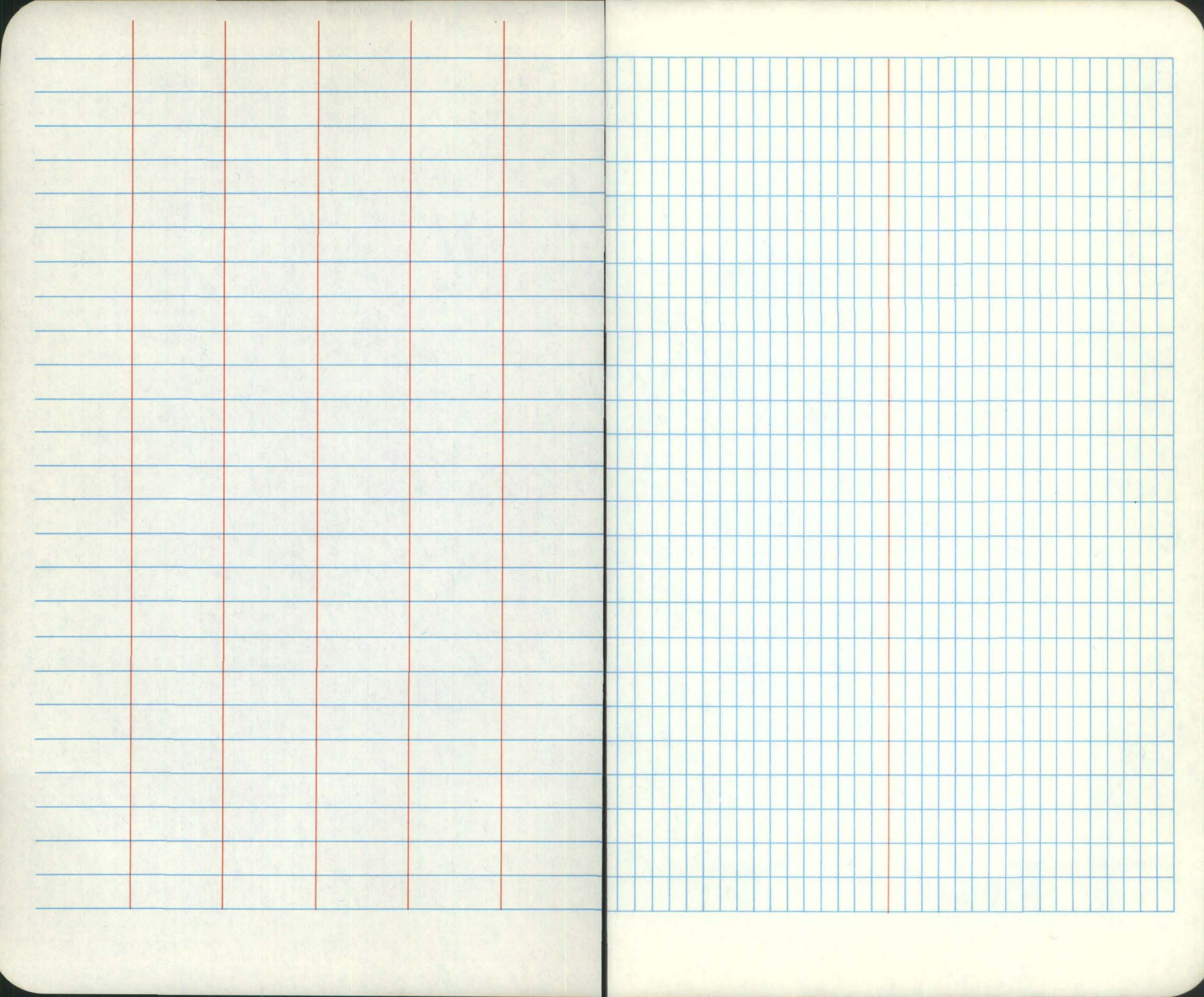
Began rubblizing @ 9:30 at

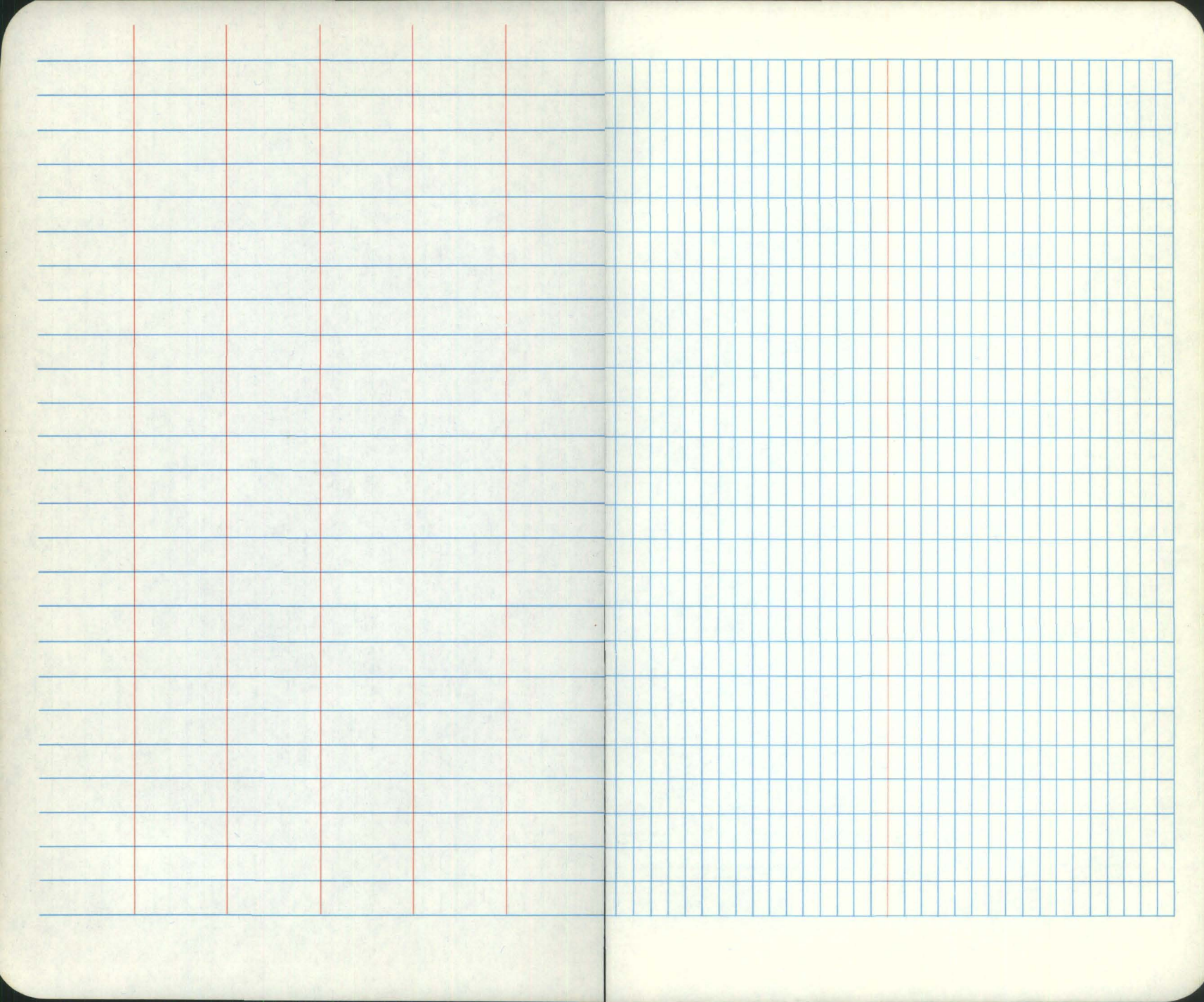
Dysart Rd. end; Sta

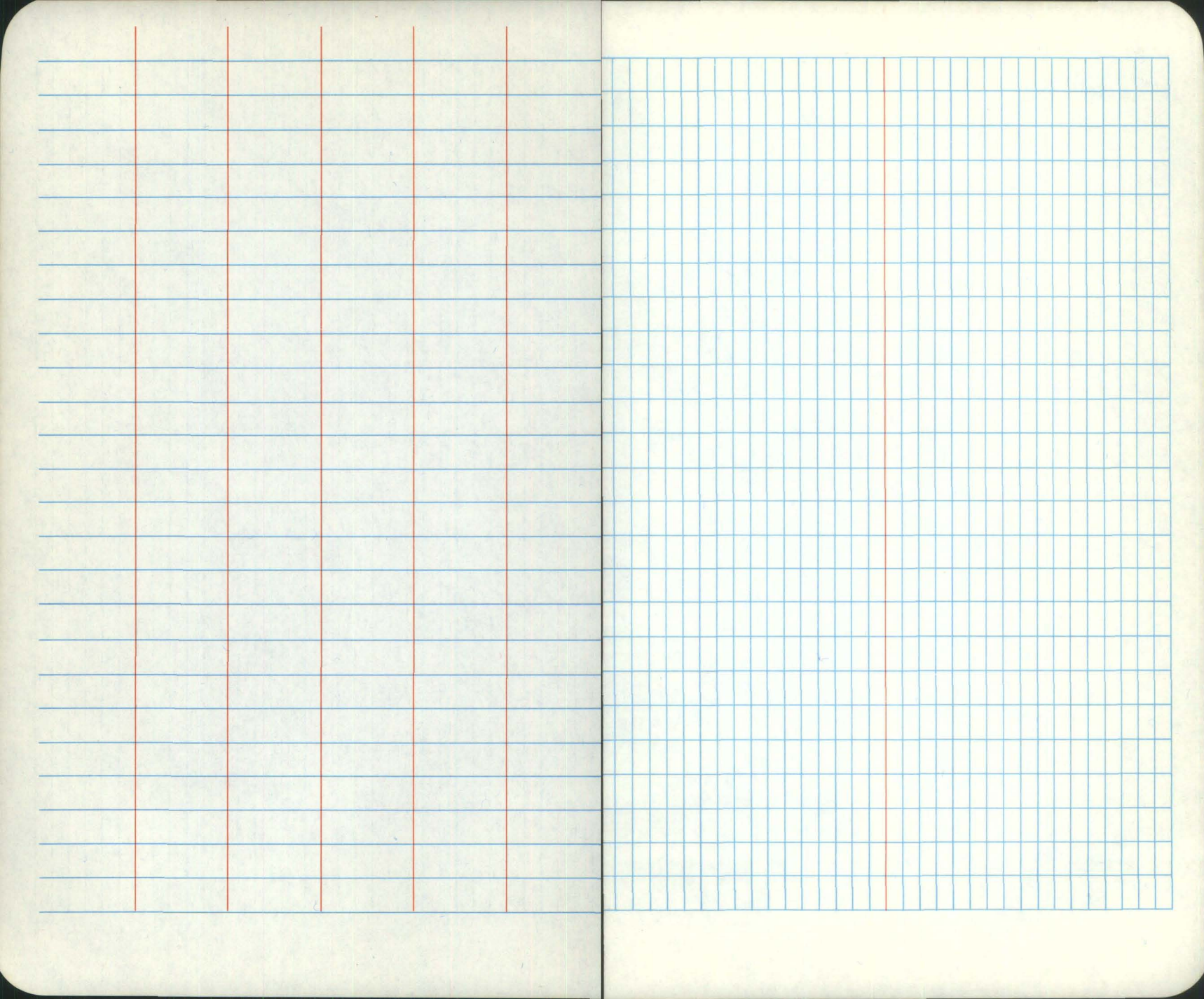
Quit @ 5:30 at Sta

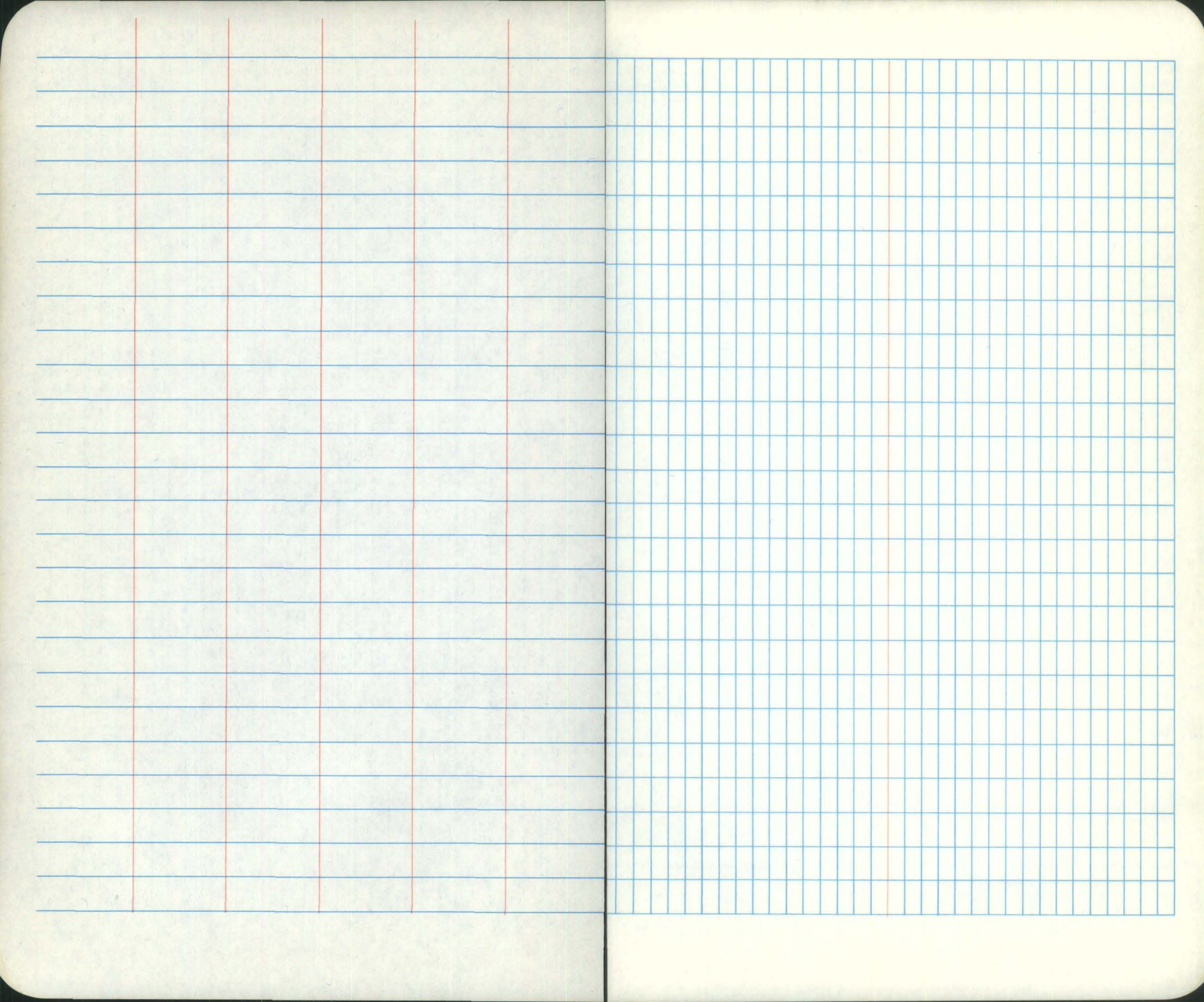
$$4017^{\text{ft}} \times 14^{\text{ft}} = 6250$$

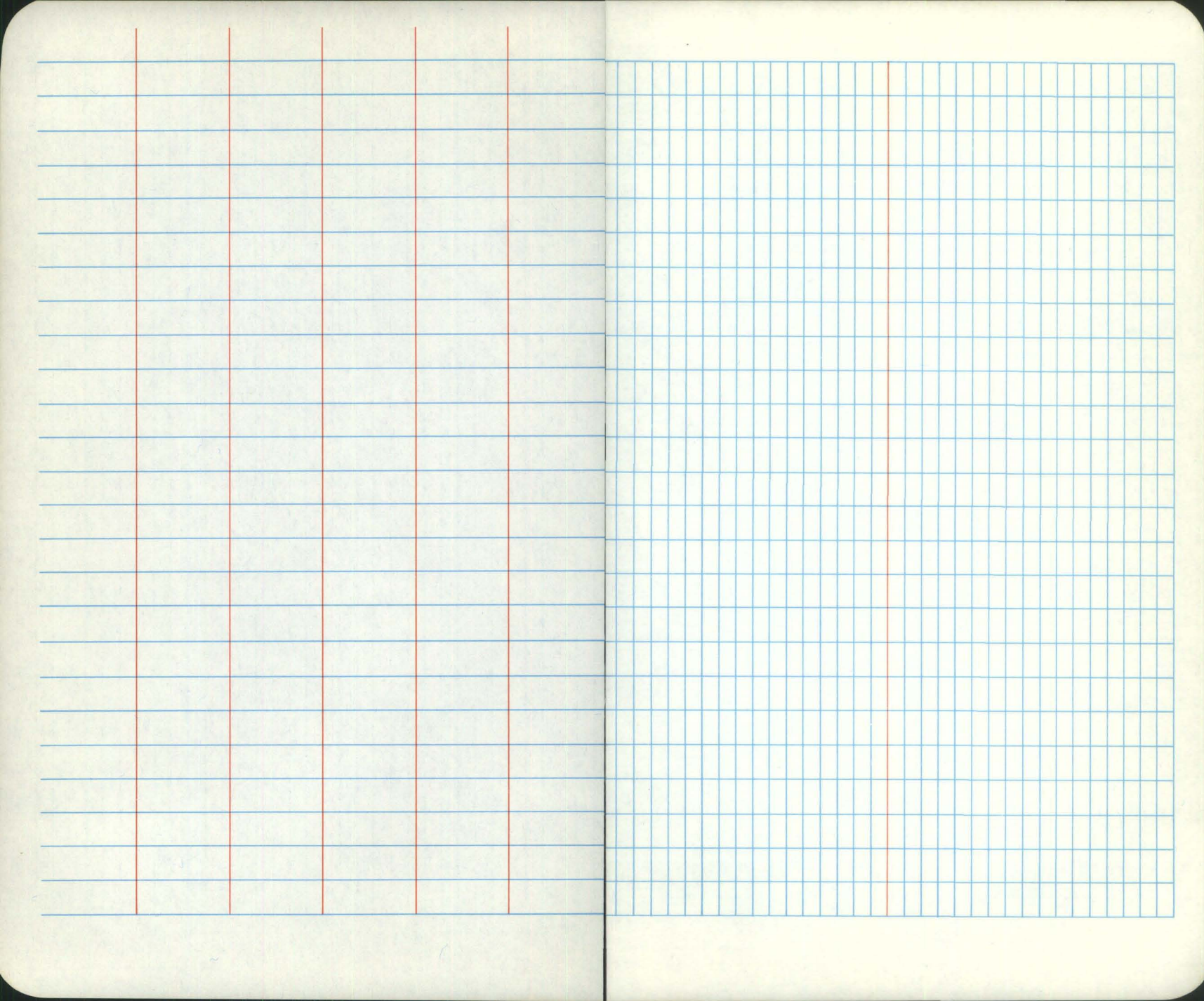


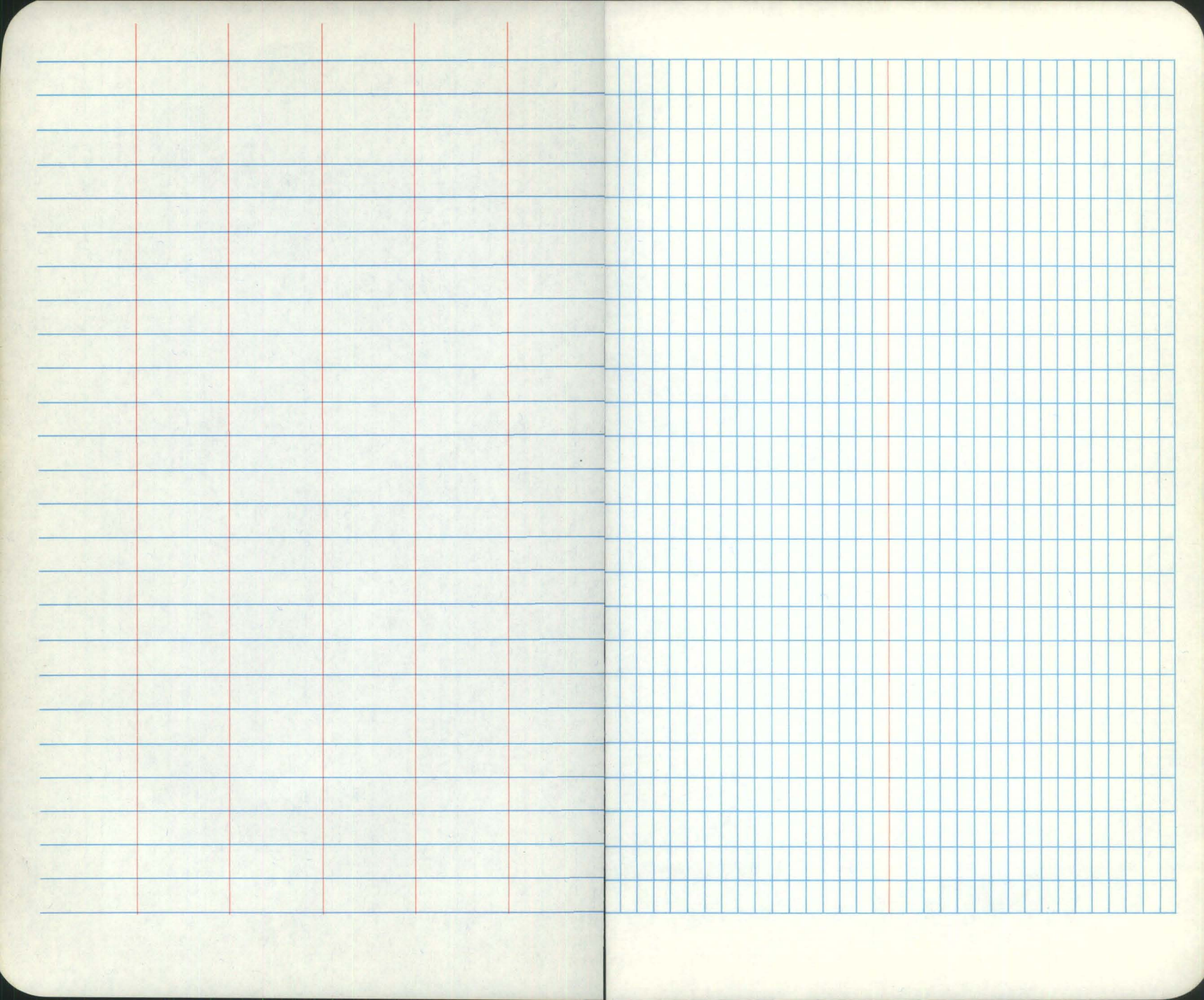


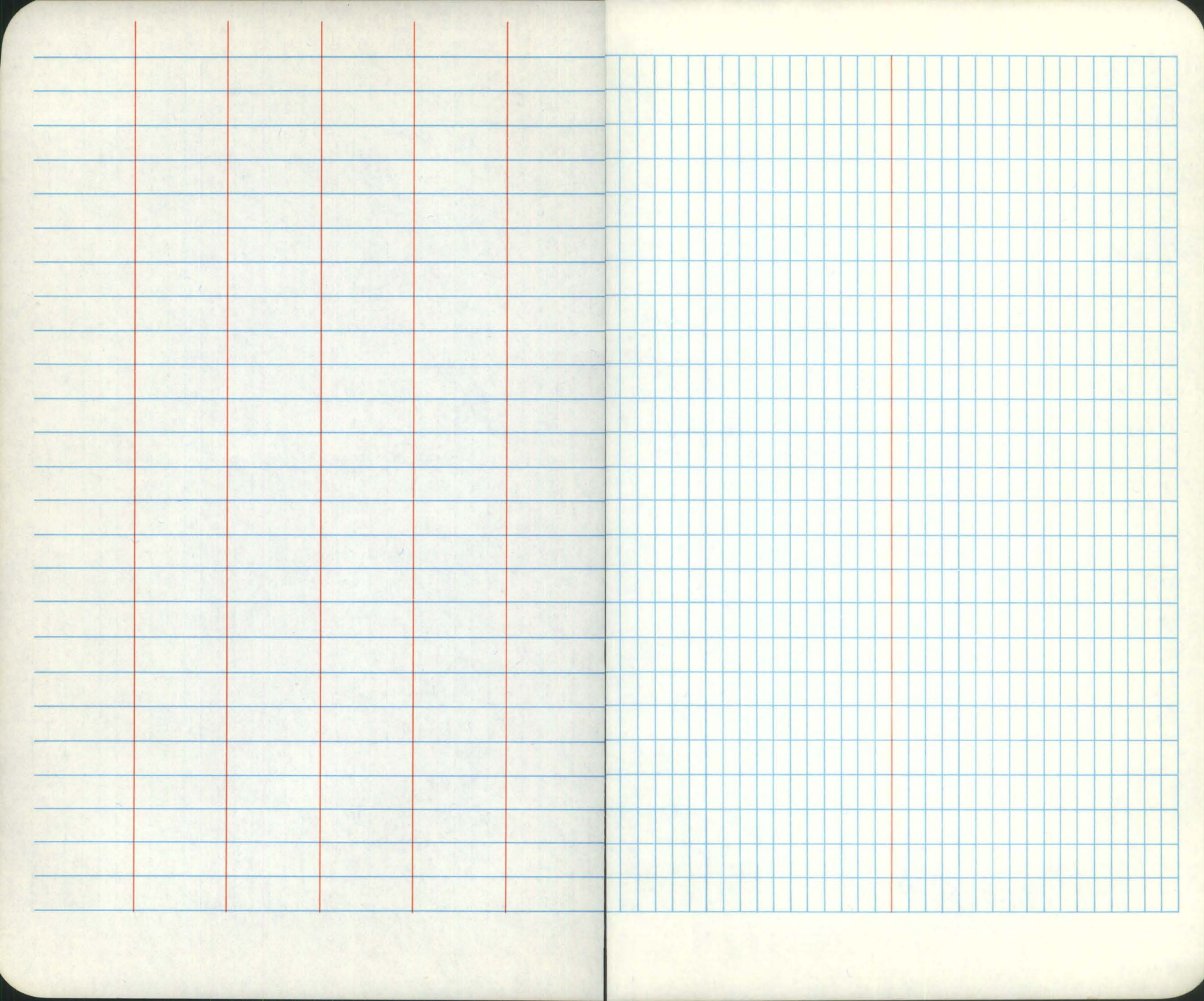


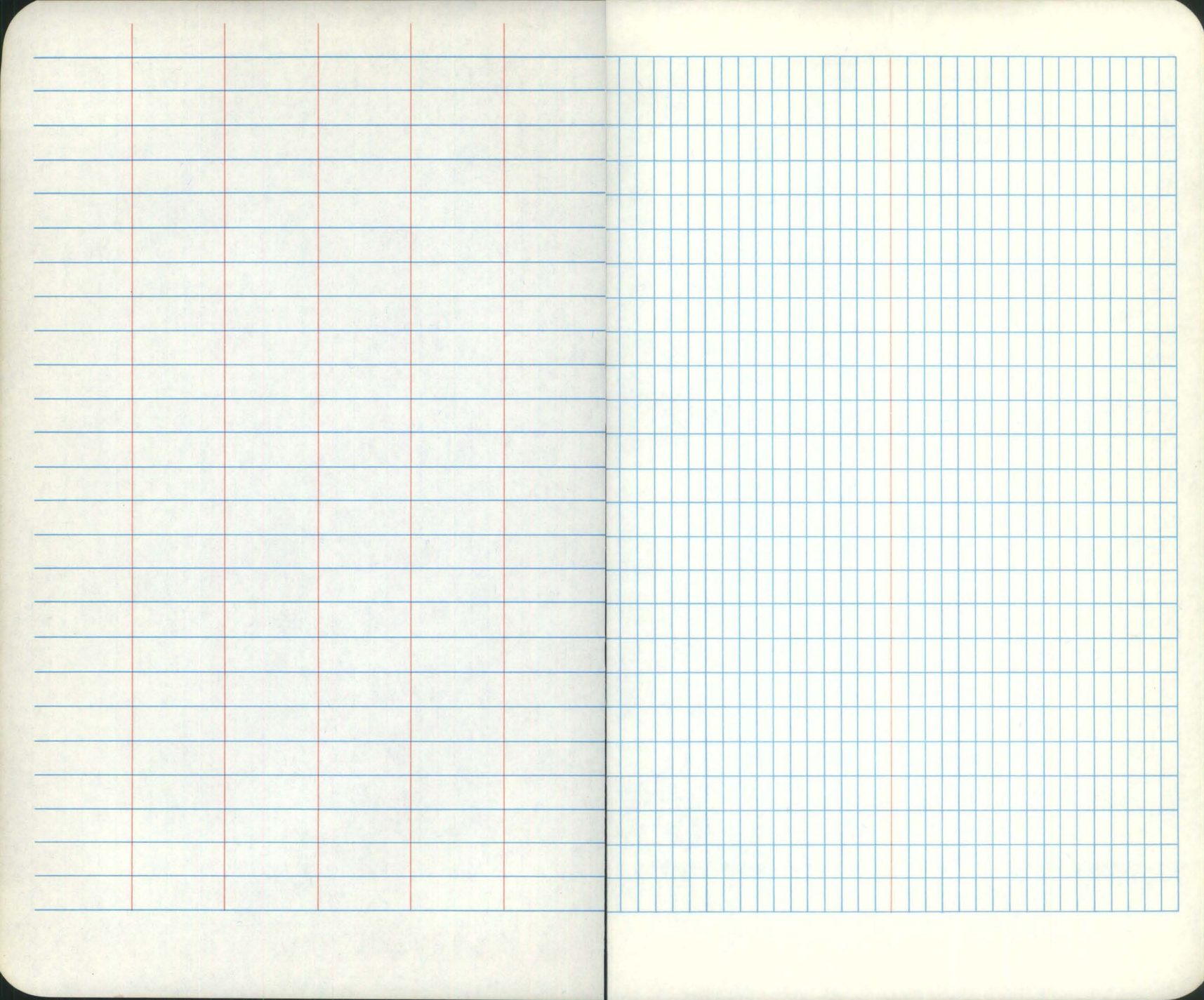


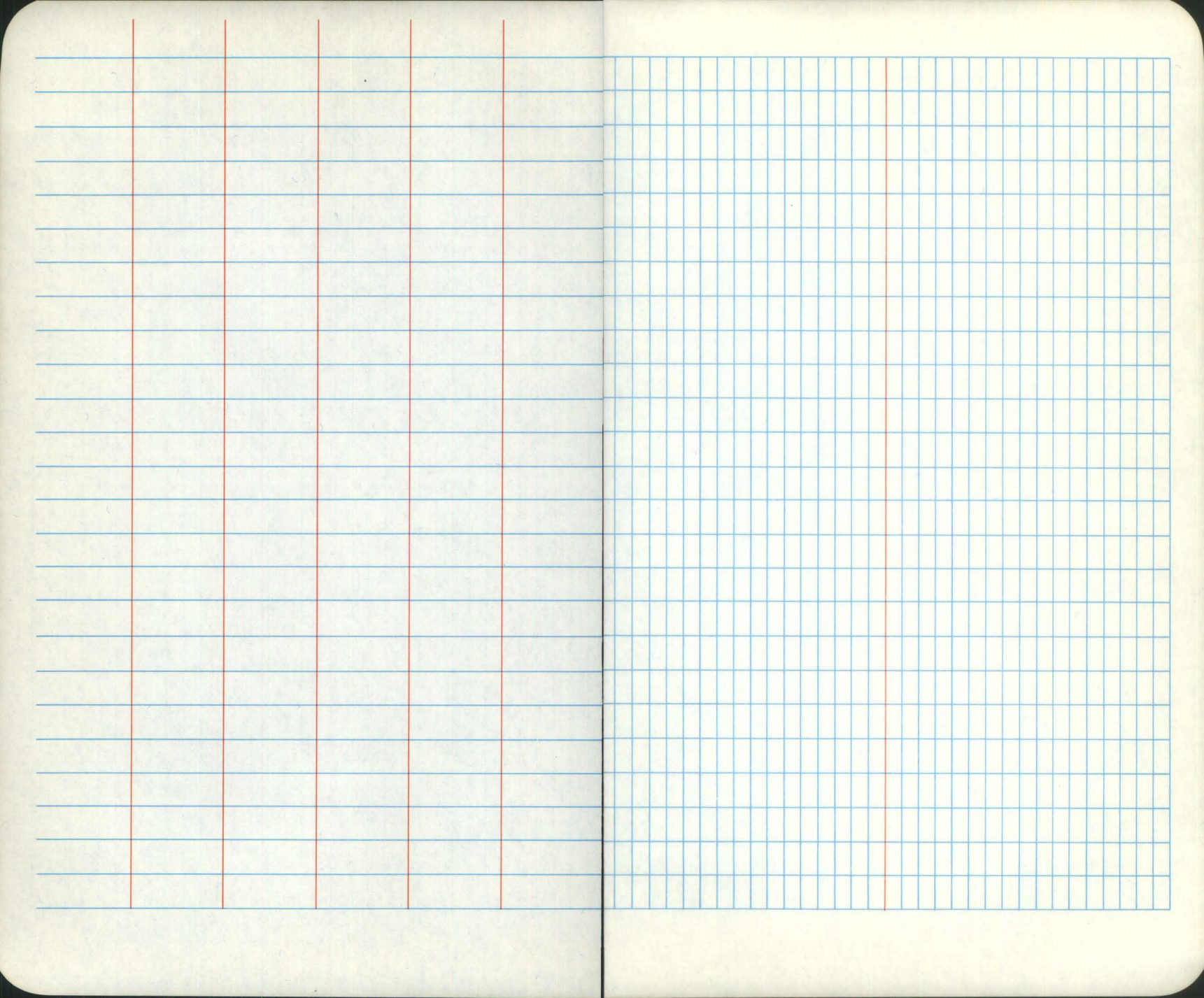


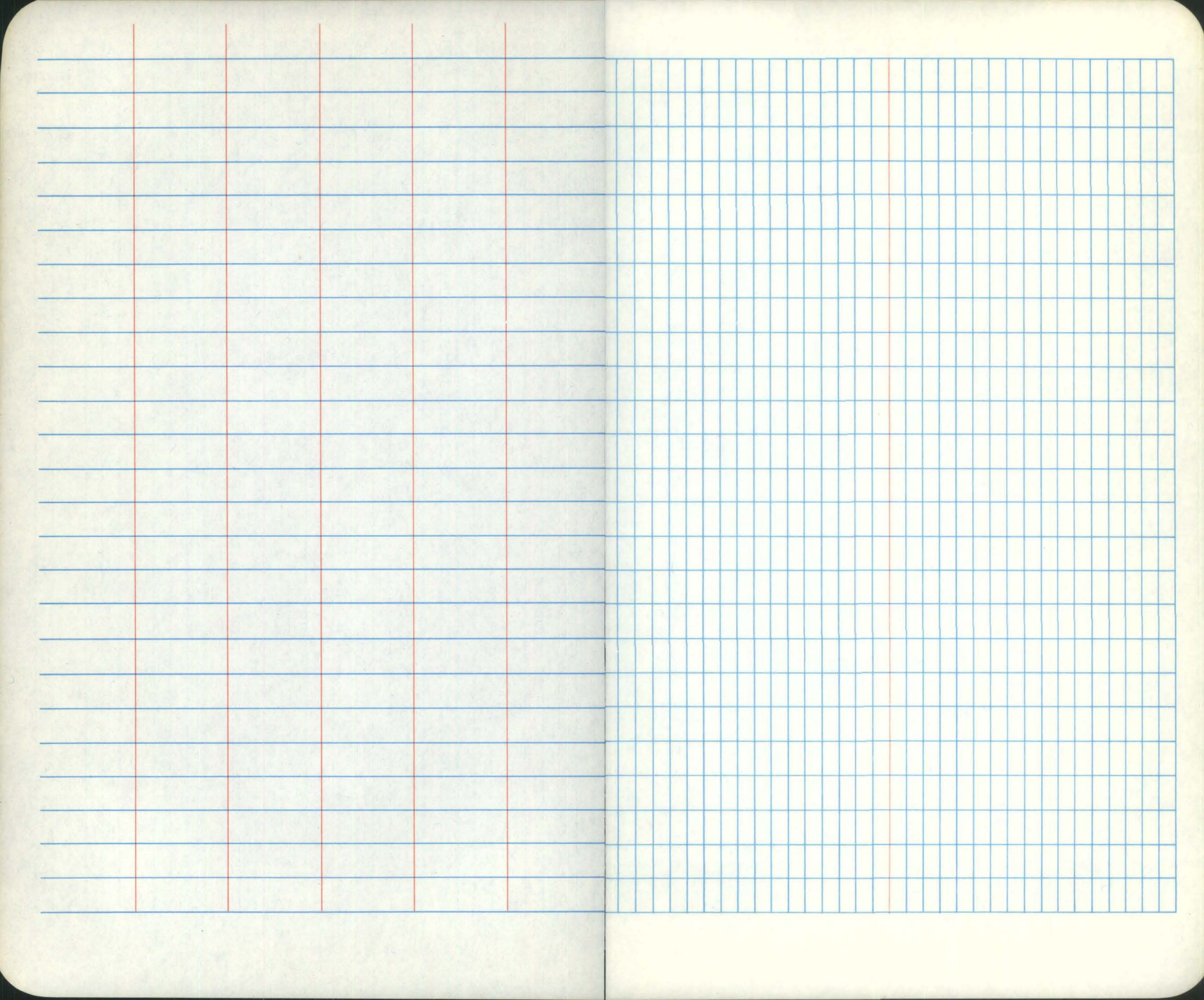


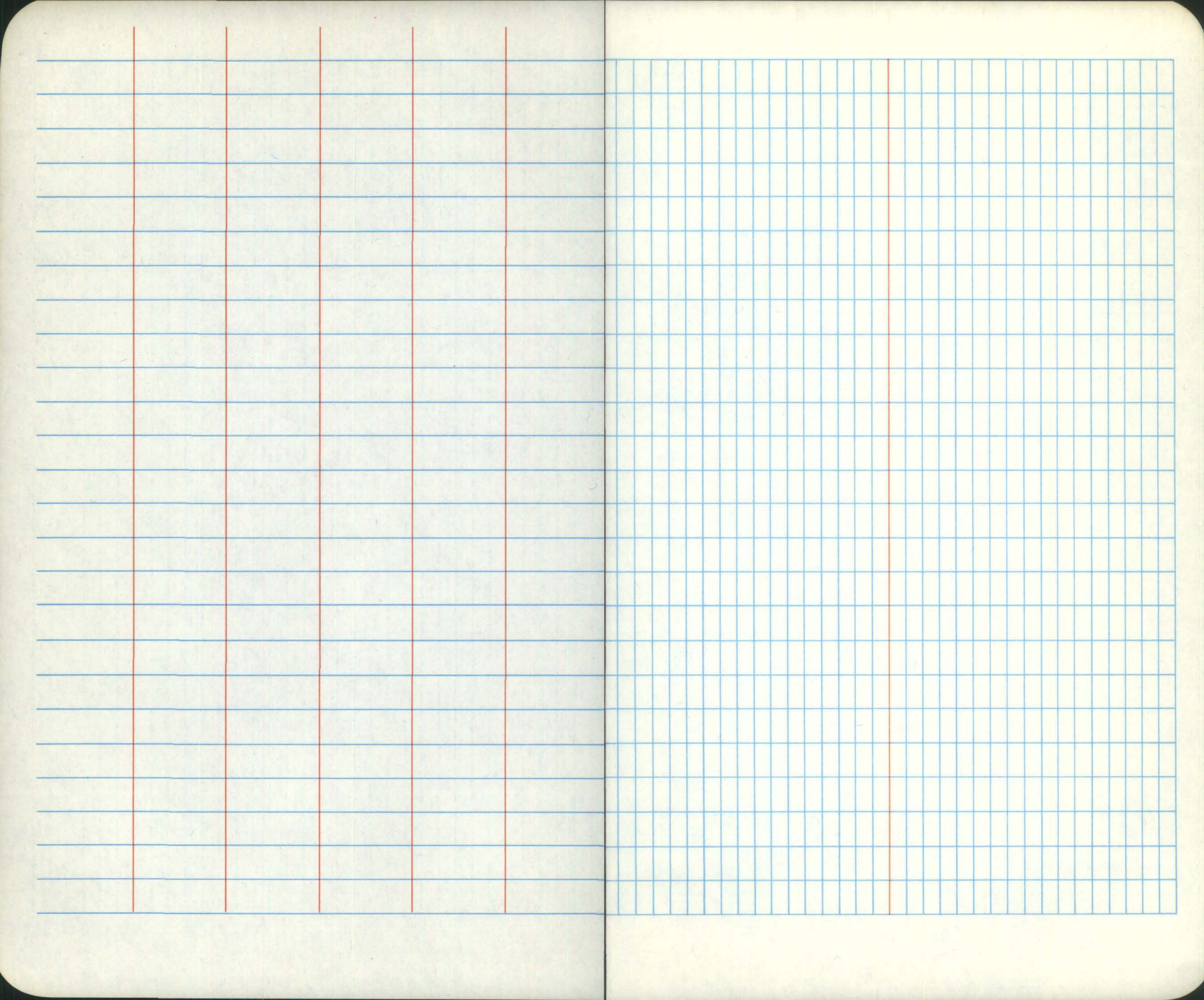


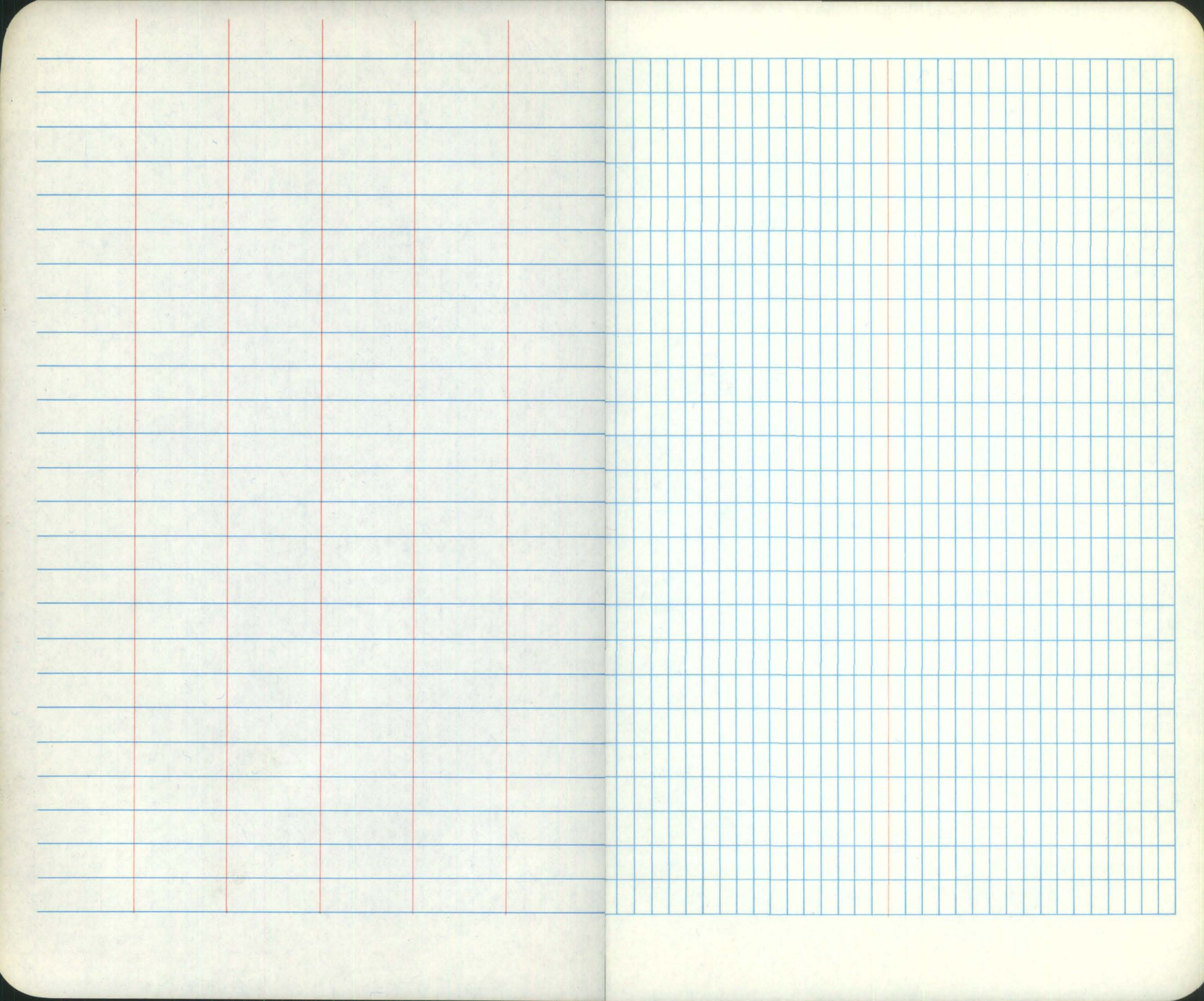


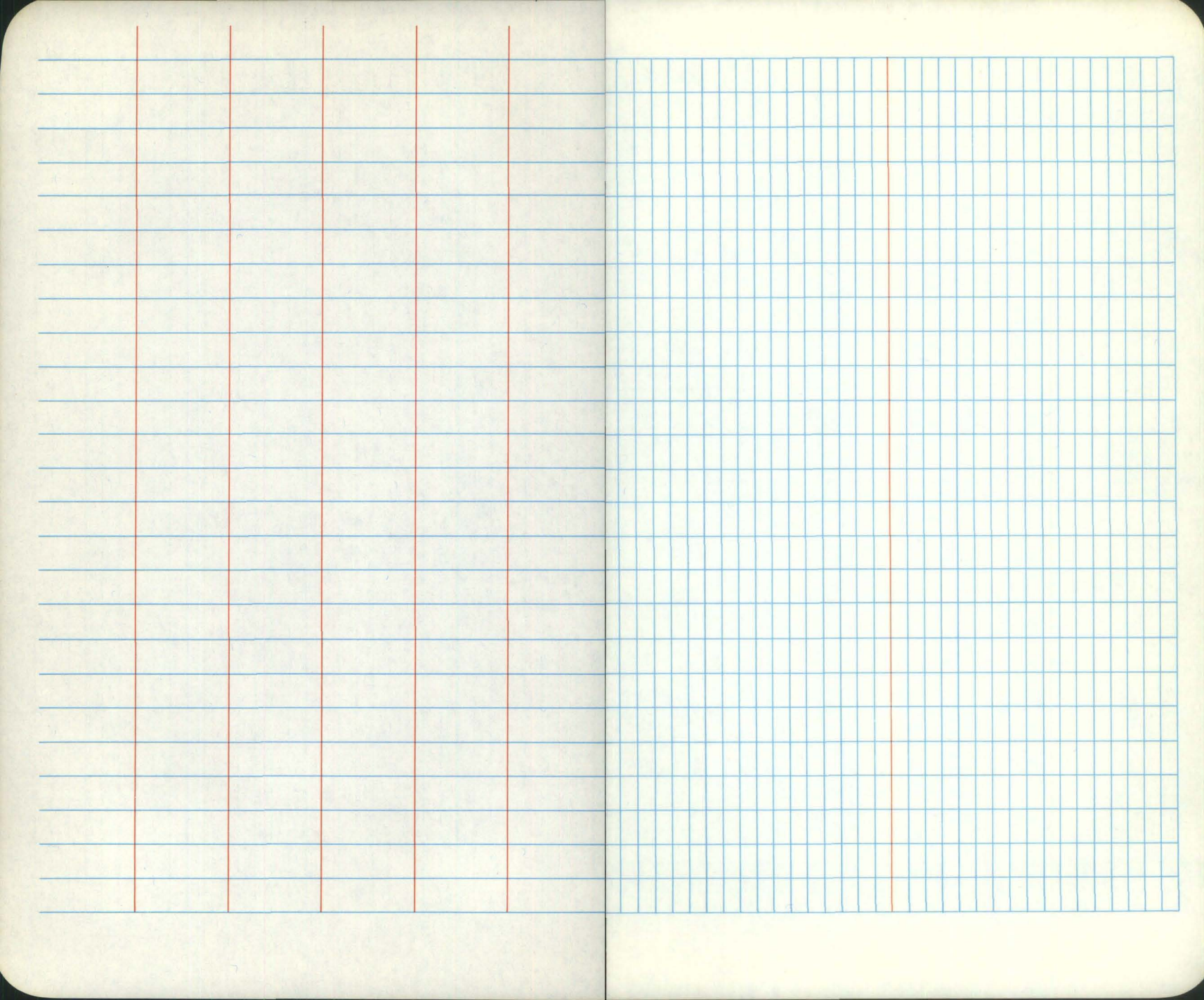


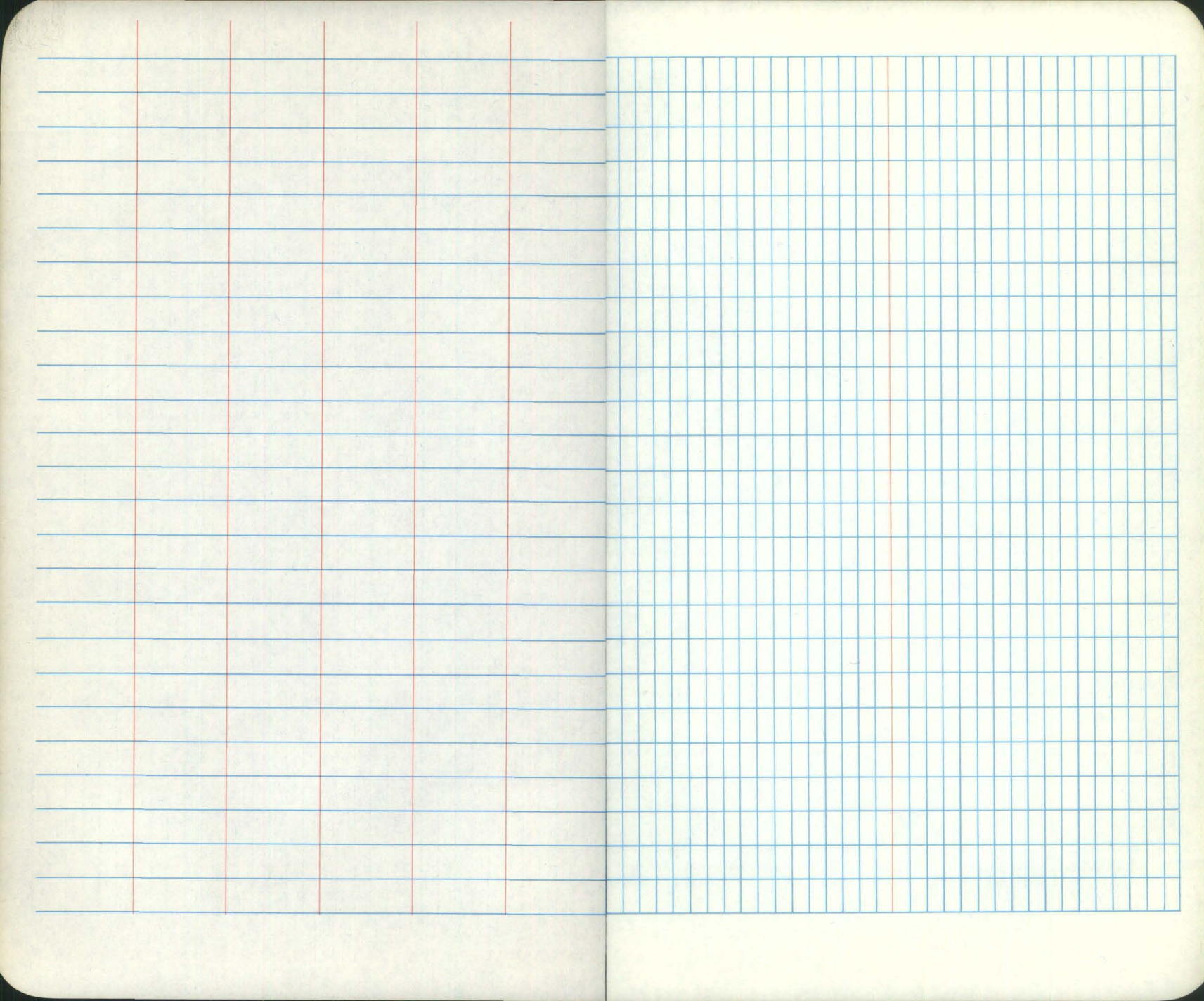


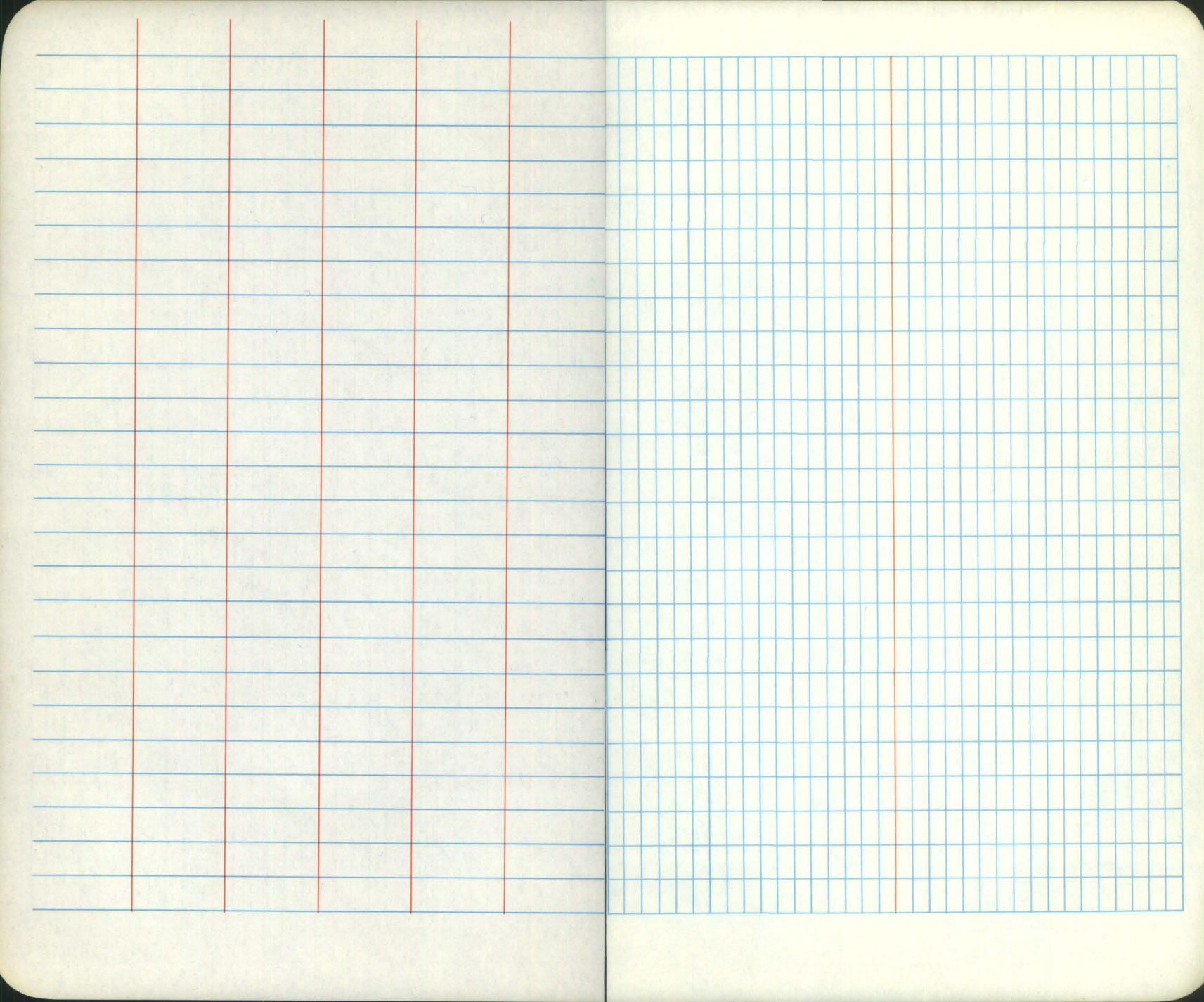


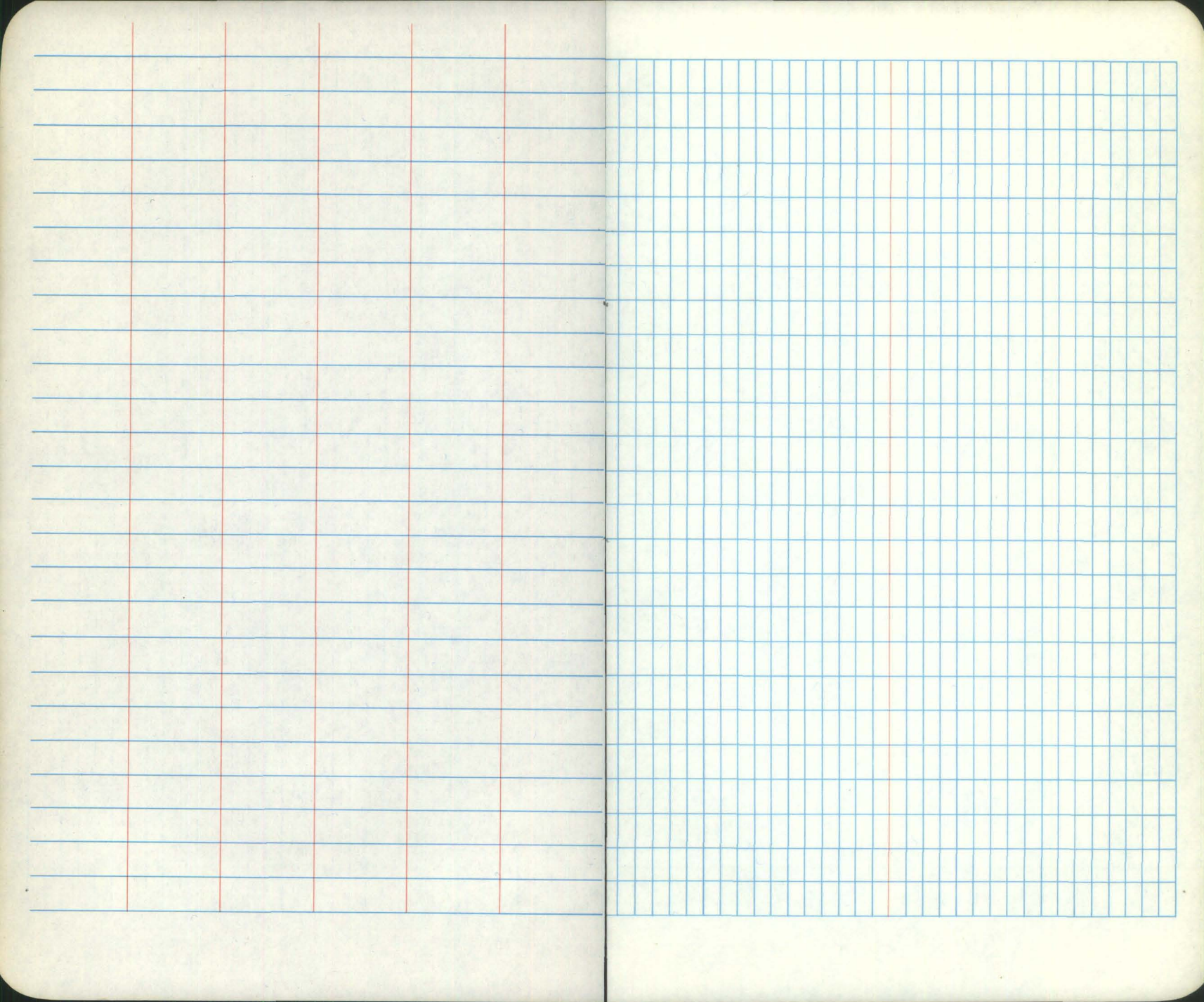


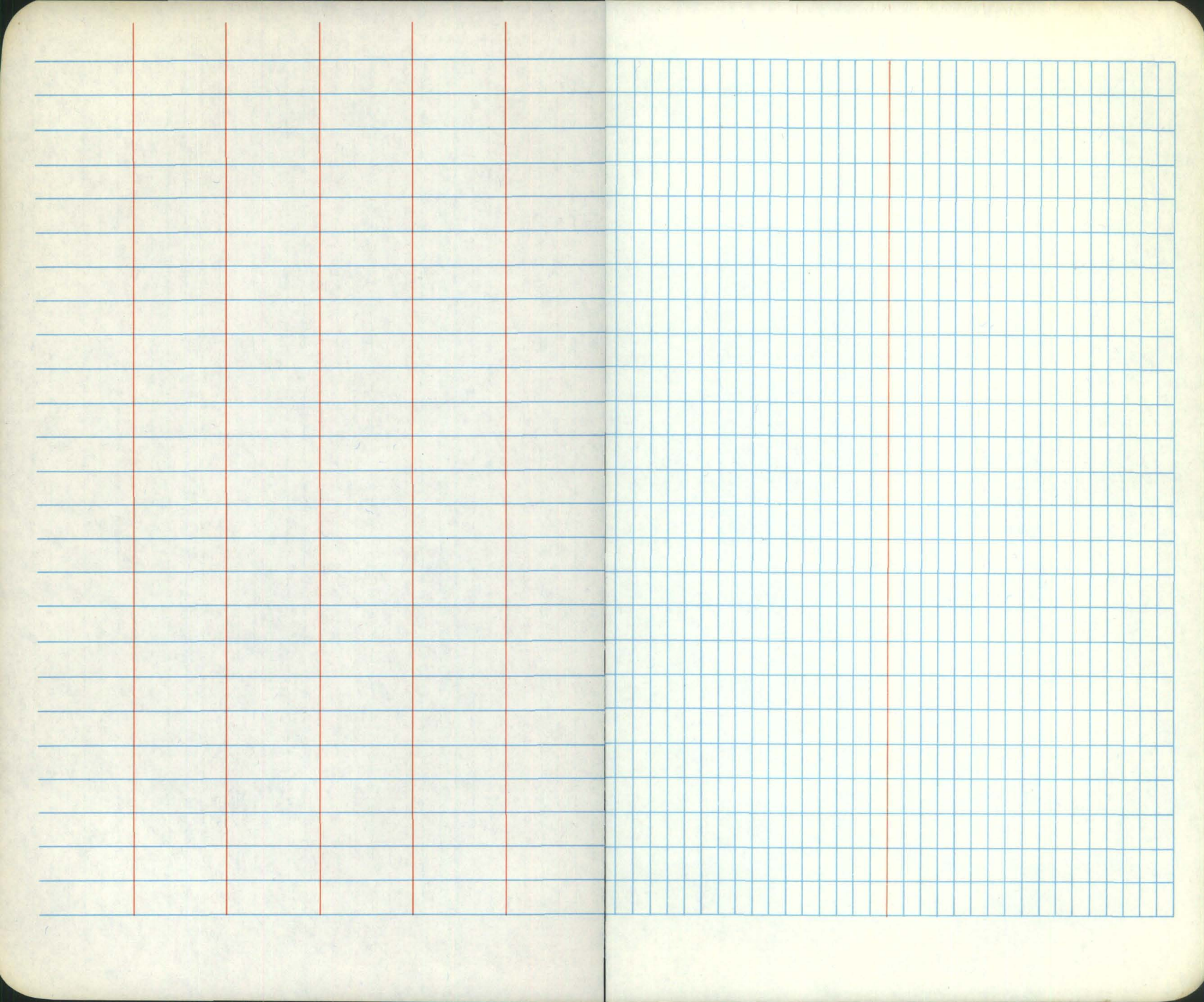


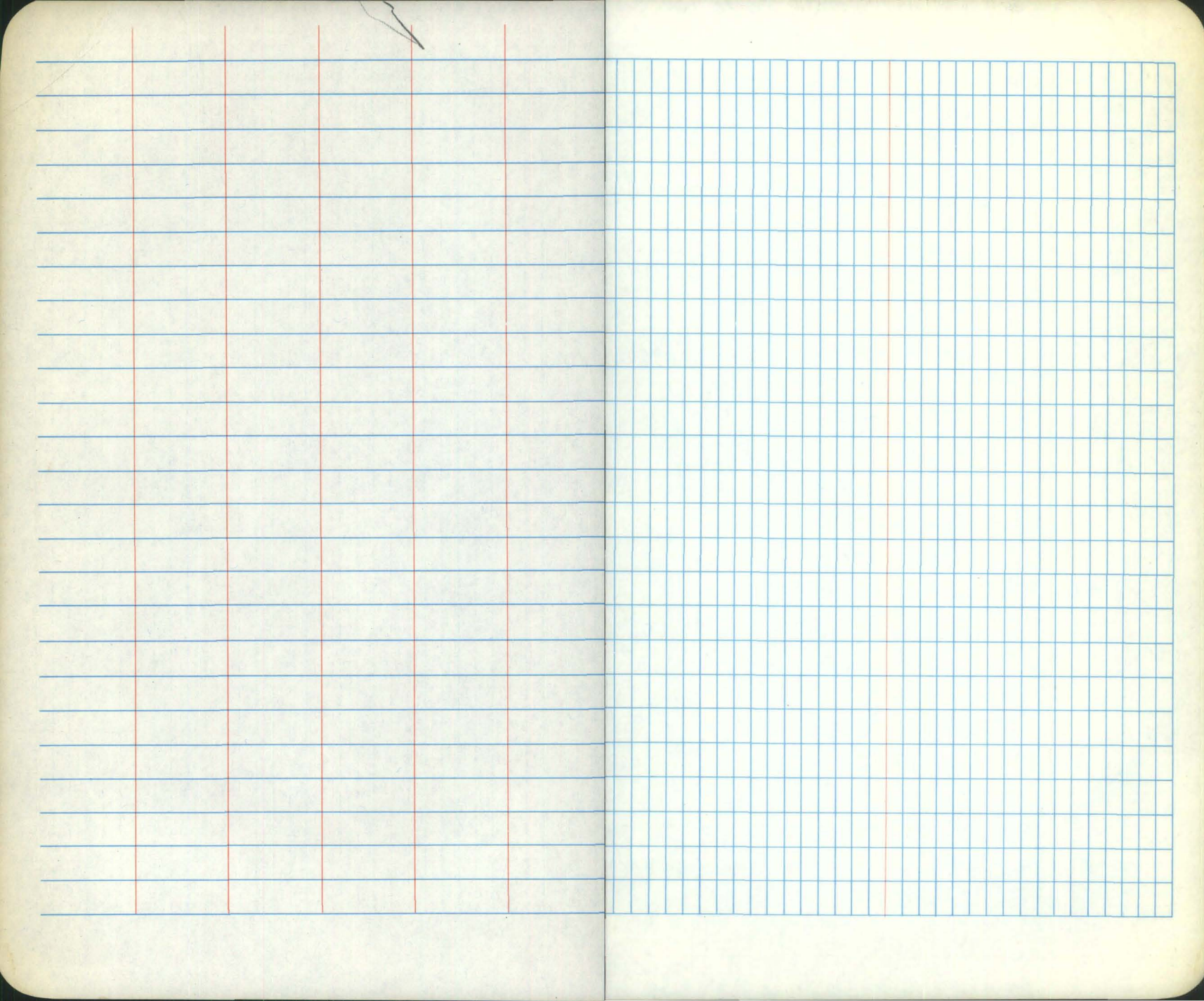


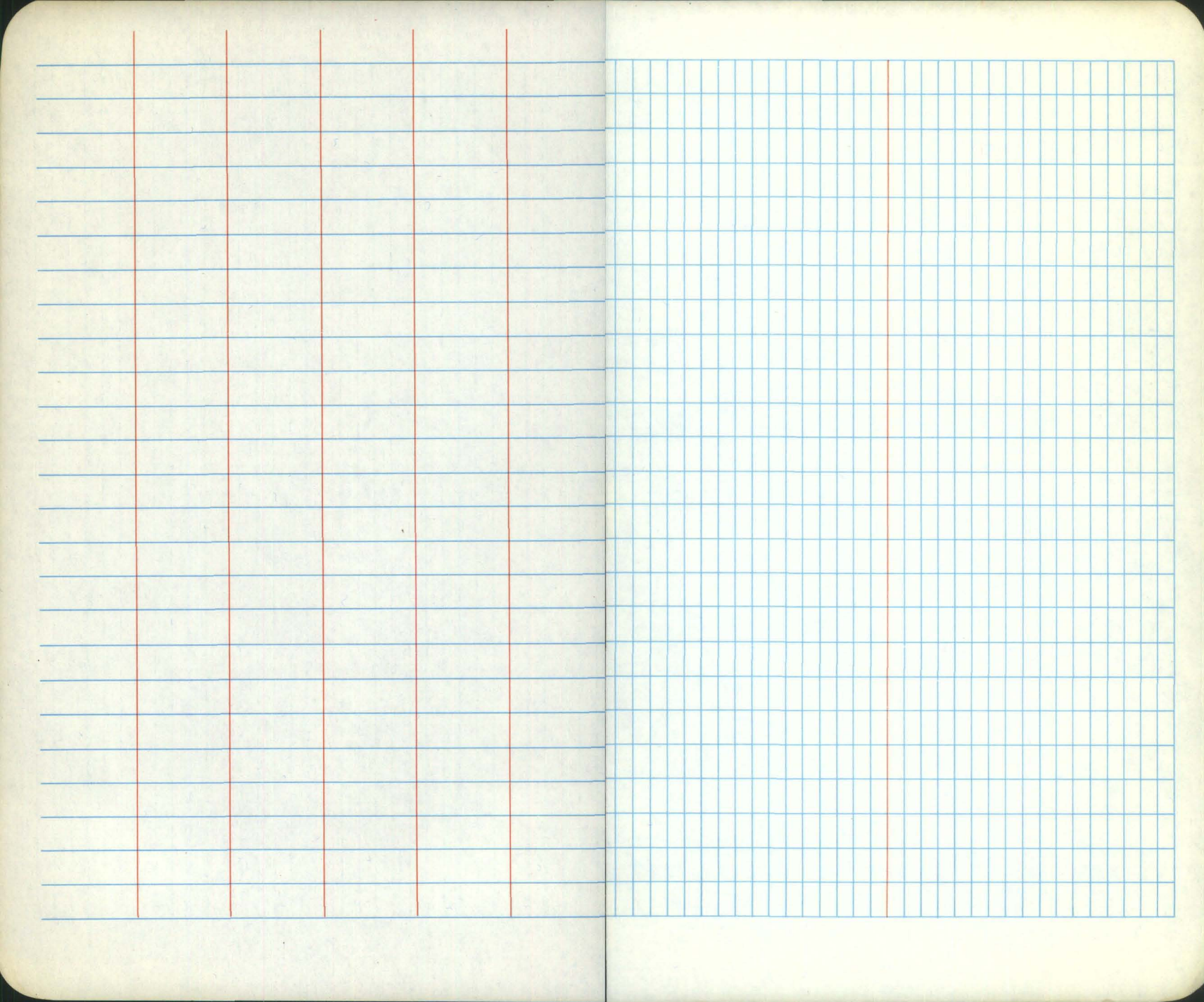




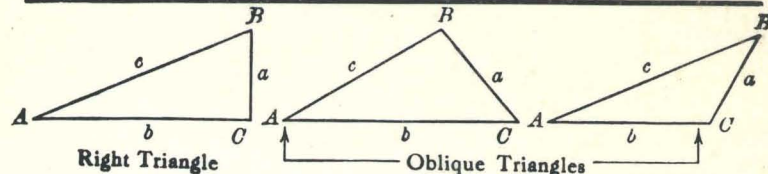








TRIGONOMETRIC FORMULÆ



Solution of Right Triangles

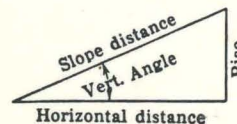
For Angle A. $\sin = \frac{a}{c}$, $\cos = \frac{b}{c}$, $\tan = \frac{a}{b}$, $\cot = \frac{b}{a}$, $\sec = \frac{c}{a}$, $\operatorname{cosec} = \frac{c}{b}$

Given a, b	Required A, B, c	$\tan A = \frac{a}{b} = \cot B, c = \sqrt{a^2 + b^2} = a \sqrt{1 + \frac{b^2}{a^2}}$
a, c	A, B, b	$\sin A = \frac{a}{c} = \cos B, b = \sqrt{(c+a)(c-a)} = c \sqrt{1 - \frac{a^2}{c^2}}$
A, a	B, b, c	$B = 90^\circ - A, b = a \cot A, c = \frac{a}{\sin A}$
A, b	B, a, c	$B = 90^\circ - A, a = b \tan A, c = \frac{b}{\cos A}$
A, c	B, a, b	$B = 90^\circ - A, a = c \sin A, b = c \cos A$

Solution of Oblique Triangles

Given A, B, a	Required b, c, C	$b = \frac{a \sin B}{\sin A}, C = 180^\circ - (A + B), c = \frac{a \sin C}{\sin A}$
A, a, b	B, c, C	$\sin B = \frac{b \sin A}{a}, C = 180^\circ - (A + B), c = \frac{a \sin C}{\sin A}$
a, b, C	A, B, c	$A + B = 180^\circ - C, \tan \frac{1}{2}(A - B) = \frac{(a - b) \tan \frac{1}{2}(A + B)}{a + b}$ $c = \frac{a \sin C}{\sin A}$
a, b, c	A, B, C	$s = \frac{a + b + c}{2}, \sin \frac{1}{2}A = \sqrt{\frac{(s - b)(s - c)}{bc}}$ $\sin \frac{1}{2}B = \sqrt{\frac{(s - a)(s - c)}{ac}}, C = 180^\circ - (A + B)$
a, b, c	Area	$s = \frac{a + b + c}{2}, \text{area} = \sqrt{s(s - a)(s - b)(s - c)}$
A, b, c	Area	$\text{area} = \frac{bc \sin A}{2}$
A, B, C, a	Area	$\text{area} = \frac{a^2 \sin B \sin C}{2 \sin A}$

REDUCTION TO HORIZONTAL



Horizontal distance = Slope distance multiplied by the cosine of the vertical angle. Thus: slope distance = 319.4 ft. Vert. angle = $5^\circ 10'$. From the table, $\cos 5^\circ 10' = .9959$. Horizontal distance = $319.4 \times .9959 = 318.09$ ft.
Horizontal distance also = Slope distance minus slope distance times (1 - cosine of vertical angle). With the same figures as in the preceding example, the following result is obtained. $\cos 5^\circ 10' = .9959, 1 - .9959 = .0041, 319.4 \times .0041 = 1.31, 319.4 - 1.31 = 318.09$ ft.

When the rise is known, the horizontal distance is approximately:—the slope distance less the square of the rise divided by twice the slope distance. Thus: rise = 14 ft., slope distance = 302.6 ft. Horizontal distance = $302.6 - \frac{14 \times 14}{2 \times 302.6} = 302.6 - 0.32 = 302.28$ ft.