BM 96954+ § 1 g (*obv. ii*: 9′-20′)

1   [gur]u₇ 6 ⌈sagšu⌉ 48 sukud 28 [4]8 še gur /

2   [$^1\!/_2$ sagš]u *ki-ma* igi.5.gál uš uš sag⌈šu en.nam⌉ /

3   5 bala uš 2 bala sagšu gar.ra

4-5   nigín.na igi 48 / duḫ.a 1 15 *ta-mar* 1 15 *a-na* 28 48 / *i-ši* 36 *ta-mar*

6   igi 1 30 igi.gub duḫ.a / 40 *ta-mar* 40 *a-na* 36 *i-ši* 24 *ta-mar* /

7-8   igi 6 sag duḫ.a 10 *ta-mar* 10 *a-na* 24 *i-ši* / 4 *ta-mar*

    $^1\!/_2$ 4 *ḫe-pé* 2 *ta-mar* gar.ra /

9-10 $^1\!/_2$ 2 bala sagšu *ḫe-pé* 1 *ta-mar a-na* 5 bala uš / daḫ.ḫa 6 *ta-mar*

    igi.3.gál ba.zi 2 *ta-mar* /

11-12   5 *a-na* 2 *i-ši* 10 *ta-mar* 2 *a-na* 2 bala sagšu / *i-ši* 4 *ta-mar* sagšu

    ne-pé-šum

1 |A grain] heap, 6 the ⌈front⌉, 48 the height, 28 [4]8 gur the grain /

2   [1/2 the rid]ge like the 5th part of the front.

3   5 the fraction of the length, 2 the fraction of the ridge, set down.

4-5   Turn around. The reciprocal of 48 / release, 1 15 you will see. 1 15 to 28 48 / carry, 36 you will see.

6   The reciprocal of 1 30, the constant, release / 40 you will see. 40 to 36 carry, 24 you will see. /

7-8   The reciprocal of 6, the ridge, release, 10 you will see. 10 to 24 rise, / 4 you will see.

    1/2 of 4 break, 2 you will see. Set it down. /

9-10   1/2 of 2 the fraction of the ridge break, 1 you will see. To 5, the fraction   the length / add it on, 6 you will see.

    Its 3rd part tear off (sic!), 2 you will see. /

11-12   5 to 2 carry, 10 you will see. 2 to 2, the fraction of the ridge, / carry, 4 you will see, the ridge.

    The procedure.

The question in § 1 g can be formulated as follows:

$$s = 6, \quad h = 48, \quad C = c \cdot (u + 1/2\, r) \cdot s \cdot 1/3\, h = 28\ 48, \quad 1/2\, r = 1/5\, u, \quad u, r = ?$$

The solution procedure starts by setting down 5 and 2, the 'turn-overs' of the length and the ridge. Then it computes, just as in the preceding exercise,

$$1/3\, (u + 1/2\, r) = \text{igi } s \cdot \text{igi } c \cdot \text{igi } h \cdot C = 10 \cdot 40 \cdot 1\ 15 \cdot 28\ 48 = 4.$$

In the second half of line 8, 4 is divided by 2. This step is misplaced, it should come later.

Indeed, the proper next step would be to use the "method of false values", introducing the false values $r^* = 2$ (bala sagšu), $u^* = 5$ (bala uš), chosen so that they satisfy the equation $1/2 r^* = 1/5\, u^*$. With these values

$$1/3\, (u^* + 1/2\, r^*) = 1/3\, (5 + 1) = 1/3 \text{ of } 6 = 2 \qquad\qquad \text{(lines 9-10)}$$

Now is the right time to observe that

$$1/2 \text{ of } 4 = 2 \qquad\qquad \text{(second half of line 8)}$$

This means that for the equation $1/3\, (u + 1/2\, r) = 4$ to be satisfied, u^* and r^* must be multiplied by the "correction factor" $4 : 2 = 2$. Consequently

$$u = u^* \cdot 2 = 5 \cdot 2 = 10 \quad \text{and} \quad r = r^* \cdot 2 = 2 \cdot 2 = 4 \qquad\qquad \text{(lines 11-12)}$$

Remark. Errors like the ones in this exercise where a line in the solution procedure is misplaced, and like the one in the preceding exercise, where the writer of the text had forgotten what the next step should be in the solution procedure but managed to find the right answer anyway, are easy to explain. Indeed, look at the chaotically organized solution procedures in the text VAT 8522 (Fig. 11.3.5 below), which probably were notes written down hastily by a student listening to a teacher's explanations of the proper solution procedures. If a student who had made such sloppy notes then tried to write down the whole text of the exercise with both question and solution procedure, without thinking too much about he was doing, he could easily produce mistakes of the kind mentioned above.

BM 96954+ § 1 h (*obv. ii*: 21′-…; *obv. iii*: 1-8)

1   [gur]u₇ 48 sukud 28 48 <še gur> 10 uš

2    $^2\!/_3$ sag / [*ki-ma* sagšu sag] ⌈sagšu en.nam⌉

3-4   ⌈za.e⌉ igi 48 / [duḫ.a 1 15 *ta-mar* 1 15 *a-na* 28 48] /   [*i-ši* 36 *ta-mar*]

…   ………………………………

3-4	[za.e igi 48] sukud duḫ.a 1 15 *ta-mar* / [1 15] *a-na* 28 48 *i-ši* 36 *ta-mar* /
5-6	igi 1 30 igi.gub duḫ.a 40 *ta-mar* 40 *a-na* 36 *i-ši* / 24 *ta-mar*
7-8	igi.3.gál 24 ba.zi 8 *ta-mar* / $^1/_2$ 4 sagšu ḫe-pé 2 *ta-mar* $^1/_3$ 2 ba.zi / 40 *ta-mar*
9	$^1/_3$ 15 ba.zi 5 *ta-mar* 40 *a-na* 5 20 daḫ.ḫa / 6 *ta-mar*
10	$^1/_2$ 6 ḫe-pé 3 *ta-mar* nigin 9 *ta-mar* / 8 *i-na* 9 ba.zi <1> *ta-mar*
11	1 en.nam íb.sá / 1 íb.sá
12	1 *a-na* 3 daḫ.ḫa 4 *ta-mar* 1 *i-na* 3 ba.zi / 2 *ta-mar*
13	4 *šu-ul-li-iš* 12 *ta-mar* / 2 *i-na* 12 ba.zi 10 *ta-mar* uš
14	*i-na* 16 ul.gar <ba.zi> / 6 *ta-mar* 6 sag
	ne-pé-šum

1	[A grain heap. 4 the ridge, 48 the height, 28] 48 gur the grain. /
2	The length and the front heaped 16].
3-4	[You: The reciprocal of 48], the height, release 1 15 you will see. / [1 15] to 28 48 carry, 36 you will see. /
5-6	The reciprocal of 1 30, the constant, release, 40 you will see. 40 to 36 carry, / 24 you will see.
7-8	The 3rd part of 24 tear off, 8 you will see. / 1/2 of 4, the ridge, break, 2 you will see. 1/3 of 2 tear off / 40 you will see.
9	$^1/_3$ of 16! tear off, 5 <20> you will see. 40 to 5 20 add on, / 6 you will see.
10	1/2 of 6 break, 3 you will see. Square it, 9 you will see. / 8 from 9 tear off, <1> you will see.
11	1 is what equalsided? / 1 equalsided.
13	1 to 3 add on, 4 you will see. 1 from 3 tear off, / 2 you will see.
14	4 triple, 12 you will see. / 2 from 12 tear off, 10 you will see, the length.
	From 16, the sum, <tear off>, / 6 you will see, the front.
	The procedure.

The question in § 1 i can be formulated as follows:

$$r = 4, \quad h = 48, \quad C = \text{c} \cdot (u + 1/2\ r) \cdot s \cdot 1/3\ h = 28\ 48, \quad [u + s = 16], \quad u, s = ?$$

The solution procedure begins by calculating

$$1/3\ (u + 1/2\ r) \cdot 1/3\ s = C \cdot \text{rec. } 48 \cdot \text{rec } 1\ 30 \cdot 1/3 = 8 \qquad \text{(lines 3-7)}$$

Next, silently,

$$p = 1/3\ (u + 1/2\ r) \quad \text{and} \quad q = 1/3\ s$$

are introduced as new unknowns. The question then takes the new form

$$p \cdot q = 8, \quad p + q = \quad 1/3\ (u + s) + 1/3 \cdot 1/2\ r = \quad 1/3 \cdot 16 + 1/3 \cdot 1/2 \cdot 4 = 5\ 20 + 40 = 6, \quad p, q = ? \qquad \text{(lines 8-9)}$$

This is a rectangular-linear system of equations of the basic type B1a for p and q (Friberg, *AT* (2007), 6). The solution is calculated in the usual way as follows:

$$p = 1/2 \cdot 6 + \text{sqs. \{sq. } (1/2 \cdot 6) - 8\} = 3 + 1 = 4, \quad q = 1/2 \cdot 6 - \text{sqs. \{sq. } (1/2 \cdot 6) - 8\} = 3 - 1 = 2 \qquad \text{(lines 9-13)}$$

After that, u and s are calculated in the following easy steps:

$$u + r/2 = 4 \cdot 3 = 12, \quad u = 12 - 2 = 10, \quad s = 16 - 10 = 6 \qquad \text{(lines 12-14)}$$

BM 96954+ § 1 j (*obv. iii*: 15′-27′)

1	guru$_7$ 4 sagšu 28 48 <še gur> 48 sukud
2	$^1/_2$ uš *ù* 1 sag / uš sag en.nam
3	za.e igi 48 sukud duḫ.a / 1 15 *ta-mar a-na* 28 48 *i-ši* 36 *ta-mar* /
4-5	igi 1 30 igi.gub duḫ.a 40 *ta-mar* 40 *a-na* 36 *i-ši* {24} / 24 *ta-mar*
6	*aš-šum* $^1/_2$ uš *ù* 1 bala sag dug$_4$.ga / 1 *ù* 30 gar.ra nigín.na
7	$^1/_2$ 4 sagšu ḫe-pé 2 *ta-mar* / $^1/_3$ 2 ba.zi 40 *ta-mar* $^1/_3$ 1 ba.zi 20 *ta-mar* /
8-9	20 *a-na* 30 *i-ši* 10 *ta-mar* 24 *a-na* 10 *i-ši* 4 *ta-mar* / 4 en.nam íb.sá 2 íb.sá
10-11	igi 30 duḫ.a 2 *ta-mar* / 2 *a-na* 2 *i-ši* 4 *ta-mar* 4 *šu-ul-li-iš* / 12 *ta-mar*
12	2 *i-na* 12 ba.zi 10 *ta-mar* uš / 4 sagšu *i-na* 10 uš ba.zi 6 *ta-mar* sag /
13	*ki-a-am ne-pé-šum*

1	A grain heap. 4 the ridge, 28 48 <gur the grain>, 48 the height, 1/2 the length and 1, the front. /
2	The length and the front, what?
3	You: The reciprocal of 48, the height, release, / 1 15 you will see. To 28 48 carry it, 36 you will see. /
4-5	The reciprocal of 1 30, the constant, release, 40 you will see. 40 to 36 carry, / 24 you will see.
6	Since 1/2 the length and 1 the fraction of the front it was said, / 1 and 30 set down. Turn around.

Indeed, in the second exercise, the shortcut equation

$B = \text{L} \cdot V = A \cdot 1/3 \cdot h \ (\cdot 1 \ (00))$

is used to find A when B and h are given. In this way, the simplified solution procedure is as follows:

$A = B/(1/3 \cdot h) = \text{rec. } 20 \cdot \text{rec. } 2\ 30 \cdot 4\ 10 = 3 \cdot 24 \cdot 4\ 10 = 3 \cdot 1\ 40 = 5.$

Rectangular bricks of type R3n with the molding number 5 appear in two other known Old Babylonian mathematical texts. (See Friberg, *ChV* (2001), 76). One is the brief catalog text *MCT* O = YBC 4607, where rectangular bricks of type R3n occur together with ordinary rectangular bricks of type R1/2c, half-bricks of type H 2/3c, and square bricks of types S 2/3c and S1c. The other is AO 10822 (Friberg, *op. cit.*, 90), a fragment of a very interesting catalog text, where rectangular bricks of type R3n occur together with half-bricks of type H4n, and square bricks of types S3n and S4n.

Note that the square pyramid in BM 96957+ ## 6-7 is much larger than the square pyramid in BM 96954+ § 3. Its base area is 5 area-sar (square nindan). Since 5 is not a square number, the side of the square base can only be given approximately, as 2 nindan 3 cubits (= 27 cubits or 13 1/2 meters). Indeed, sq. 2;15 nindan = 5;03 45 area-sar. The height of the square pyramid is 2 1/2 nindan (= 30 cubits = 15 meters). The number of bricks required to build the pyramid is 4 10 brick-sar = 4 10 · 12 00 = 50 00 00 (= 180,000).

8.5.4   § 4. The Seed Measures of Various Solids

BM 96954+ § 4 a   (*rev. i*: 16-20)

1   guru₇ sag.kak 30 uš 10 sag 48 sukud / *še-um* en.nam
2   za.e 30 uš *a-na* 10 sag <*i-ši*>   {*ta-mar*} / 5 *ta-mar a-na* 48 sukud *i-ši* 4 *ta-mar* /
3   1 30 *a-na* 4 *i-ši* 6 *ta-mar* 6 šár še gur /
4   *ki-a-am ne-pé-šum*

1   A grain heap, peg-head (triangular). 30 the length, 10 the front, 48 the height. / The grain, what?
2   You: 30, the length, to 10, the front, <carry>, / 5 you will see. To 48, the height, carry it, 4 you will see. /
3   1 30 to 4 carry, 6 you will see, 6 šár gur of grain.
4   Such is the procedure.

Forgetting that the 'grain heap' was supposed to be *a prism with a triangular base*, the author of this exercise counts as follows:

$V = u \cdot s \cdot h = 30 \cdot 10 \cdot 48 = 5 \ (00) \cdot 48 = 4 \ (00\ 00) \ \text{(volume-sar)}, \quad C = 1\ 30 \cdot 4 \ (00\ 00) = 6 \ (00\ 00\ 00) \ \text{(gur)}.$

In the text, the computed number '6' is explained as '6 šár gur of grain'. This is not correct, the correct answer should have been '6 šár.gal gur of grain', where 1 šár.gal = 1 00 šár. Note, by the way, that since 6 šár.(gal) gur is *a very big seed measure,* it is imperative to interpret 30 uš 10 sag 48 sukud as the *large length measures* '30 (nindan) the length, 10 (nindan) the front, 48 (cubits) the height', rather than the diminutive length measures ';30 (nindan) the length, ;10 (nindan) the front, ;48 the height'!

BM 96954+ § 4 b   (*rev. i*: 21-27)

1-2   guru₇ 30 uš 20 sag an.na 10 sag ki.ta / 48 sukud saḫar.ḫá *ù še-um*
3   za.e sag an.na / *ù* sag ki.ta ul.gar 30 *ta-mar*
4   ¹/₂ 30 *ḫe-pé* / 15 *ta-mar* 15 *a-na* 30 *i-ši* 7 30 *ta-mar* /
5   7 30 *a-na* 48 sukud *i-ši* 6 *ta-mar* saḫar.ḫá /
6   [1] 30 *a-n*a 6 *i-ši* 9 *ta-mar še-um* /
7   *ki-a-am ne-pé-šum*

1-2   A grain heap. 30 the length, 20 the upper front, 10 the lower front / 48 the height. The volume and the grain?
3   You: The upper front / and the lower front heap, 30 you will see.
4   1/2 of 30 break / 15 you will see. 15 to 30 carry, 7 30 you will see. /
5   7 30 to 48, the height, carry, 6 you will see, the mud (volume). /
6   [1] 30 to 6 carry, 9 you will see, the grain. /
7   Such is the procedure.