

12) Geivet: $n_s = 7$

$$\text{Formel: } \frac{R_{el}}{n_s} = \frac{F}{A}$$

$$F = 2200 \cdot 9,82 \text{ N}$$

$$R_{el} = 280 \text{ N/mm}^2$$

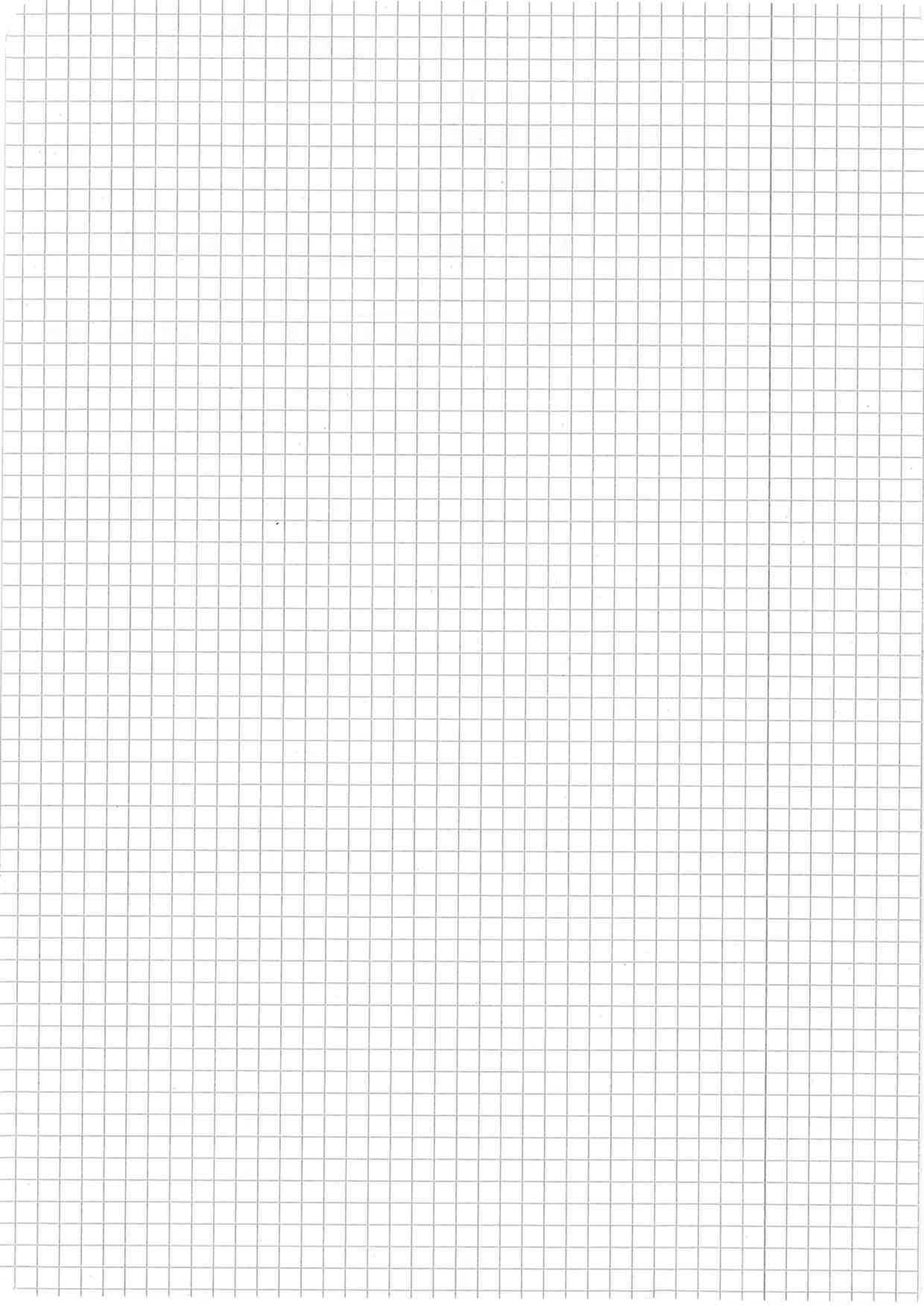
$$A = \frac{\pi \cdot D^2}{4}$$

$$\text{Lösning: } \frac{R_{el}}{n_s} = \frac{280}{7} \quad 40 = \frac{F}{A} \quad A = 540$$

$$\frac{\pi \cdot D^2}{4} = 540$$

$$\sqrt{\frac{540 \cdot 4}{\pi}} = 26,22$$

$$D = 26,2 \text{ mm}$$



13.

$$F_{\text{vagn}} = 90 \cdot 9,81 = 882,9 \text{ N}$$

$$\bar{\sigma} = 110 \text{ N/mm}^2 \quad D = 0,5 \text{ m}$$

$$A = \pi \cdot r^2 = \pi \cdot 0,25^2 = 0,196 \text{ mm}^2$$

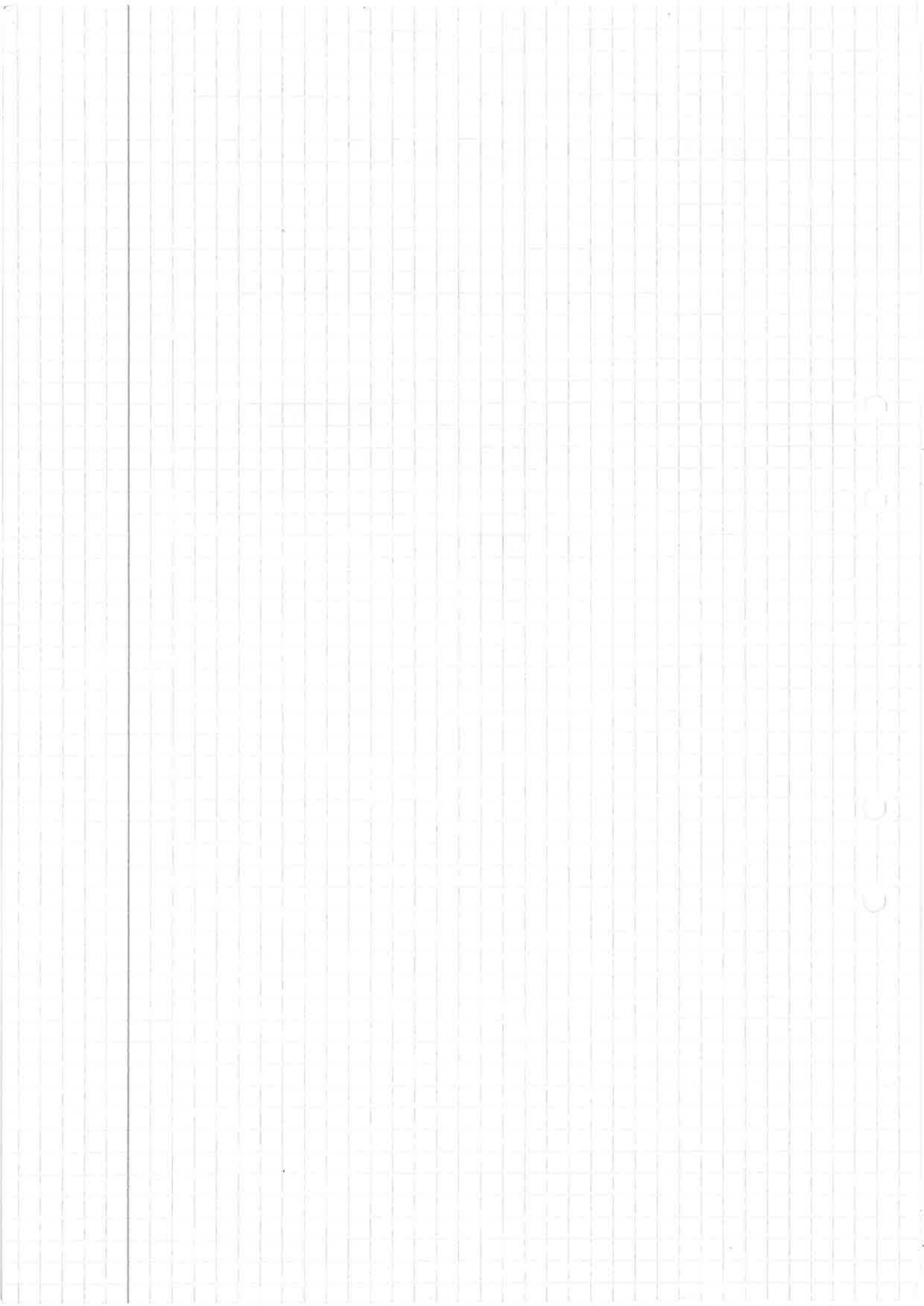
$$F_{\text{träd}} = ?$$

$$F = \sigma \cdot A$$

$$F_{\text{träd}} = 110 \cdot 0,196 = 21,598 \text{ N}$$

$$\text{Antal träd} = \frac{F_{\text{vagn}}}{F_{\text{träd}}} = \frac{882,9}{21,598} = \frac{40,8382}{40,88}$$

Snar: 41 träd



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Givna värden

$$F = 55 \cdot 10^3 \text{ [N]}$$

$$R_m = 450 \text{ [N/mm}^2\text{]}$$

$$n_b = 7.5$$

$$b = 55 \text{ [mm]}$$

$$\underline{\text{tjocklek}} = ? \text{ [mm]}$$

Formler

$$\frac{R_m}{n_b} = \frac{F}{A}$$

$$A = b \cdot \text{tjockleken} \quad (t)$$

$$\frac{R_m}{n_b} = \frac{F}{b \cdot t}$$

↓

$$t = \frac{F}{b \cdot \frac{R_m}{n_b}}$$

Lösning:

$$t = b \cdot \frac{F}{\frac{R_m}{n_b}} = \frac{55 \cdot 10^3}{55 \cdot \frac{450}{7.5}} = 16.6 \text{ mm}$$

svar: ~ 17mm

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Givna värden:

$$F = 55 \cdot 10^3 \text{ [N]}$$

$$R_m = 450 \text{ [N/mm}^2\text{]}$$

$$n_b = 7.5$$

$$s = ? \text{ [mm]}$$

Formler:

$$\frac{R_m}{n_b} = \frac{F}{A}$$

$$A = s^2 = s \cdot \frac{s^2}{s}$$

$$\frac{R_m}{n_b} = \frac{F}{r^2}$$

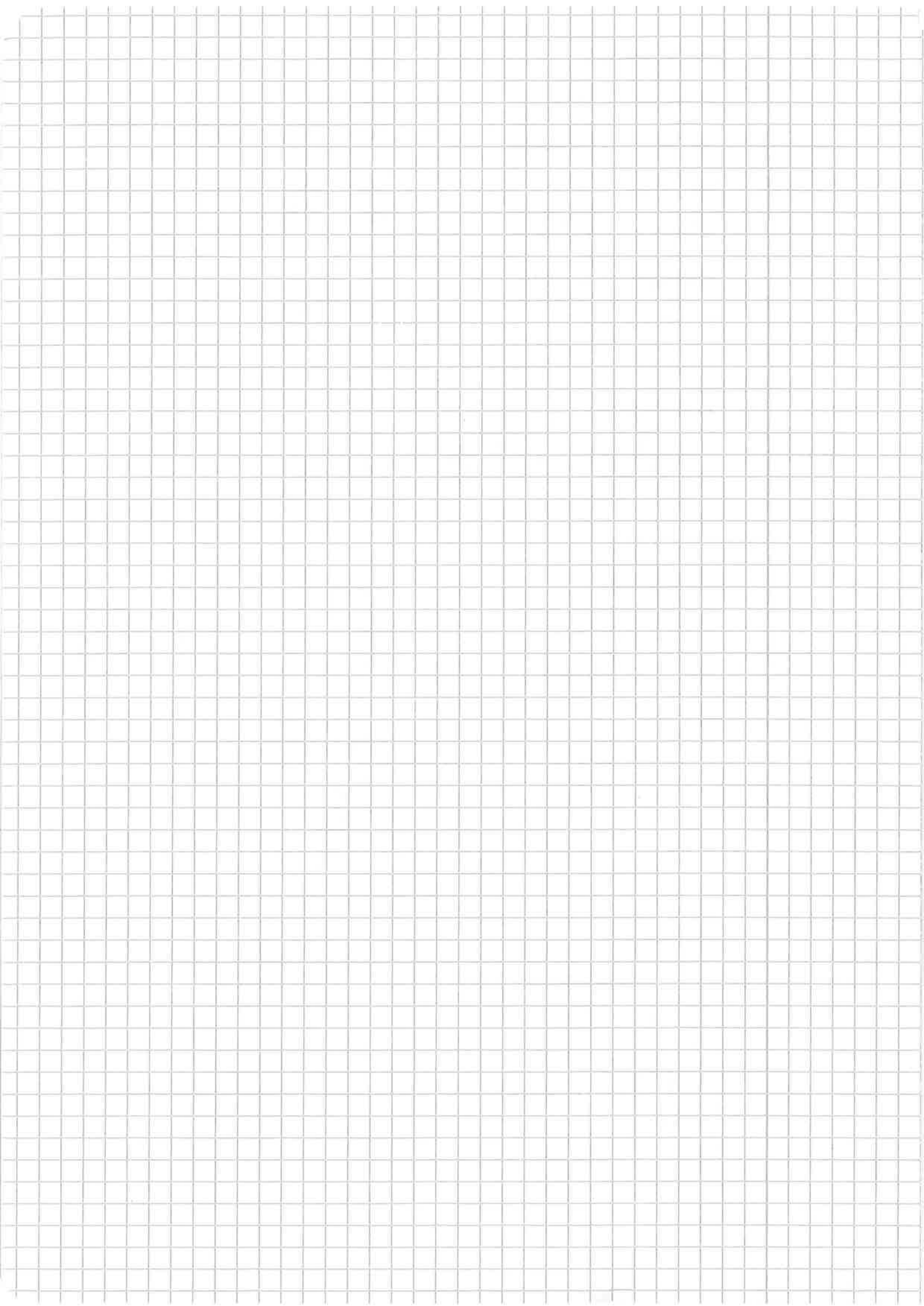
$$r^2 = \frac{F}{\frac{R_m}{n_b}}$$

Lösning:

$$r^2 = \frac{55 \cdot 10^3}{\frac{450}{7.5}} = 916.6$$

$$r = \sqrt{916.6} = 30.3 \text{ mm}$$

svar: 30.3 mm



16.

innerdiameter $iD = 85 \text{ mm}$

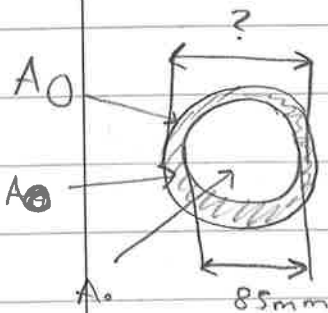
säkerhetsfaktor $n_s = 8$

sträckgräns $R_{el} = 220 \text{ N/mm}^2$

belastning $F = 1,5 \text{ ton} = 15000 \text{ N}$

ytterdiameter $yD = ?$

formler: $\frac{R_{el}}{n_s} = \frac{F}{A} = \sigma$ $A = \pi \cdot r^2$



$$\frac{R_{el}}{n_s} = \frac{220}{8} = \sigma = 27,5 \text{ N/mm}^2$$

$$\frac{R_{el}}{n_s} = \frac{F}{A} \Rightarrow \frac{15000 \text{ N}}{27,5 \text{ N/mm}^2} = A_1 = 545,4545 \text{ mm}^2$$

$$A_2 = \pi \cdot r^2 = 5624,5 \text{ mm}^2$$

($42,5^2$)

$$A_1 = A_2 - A_0$$

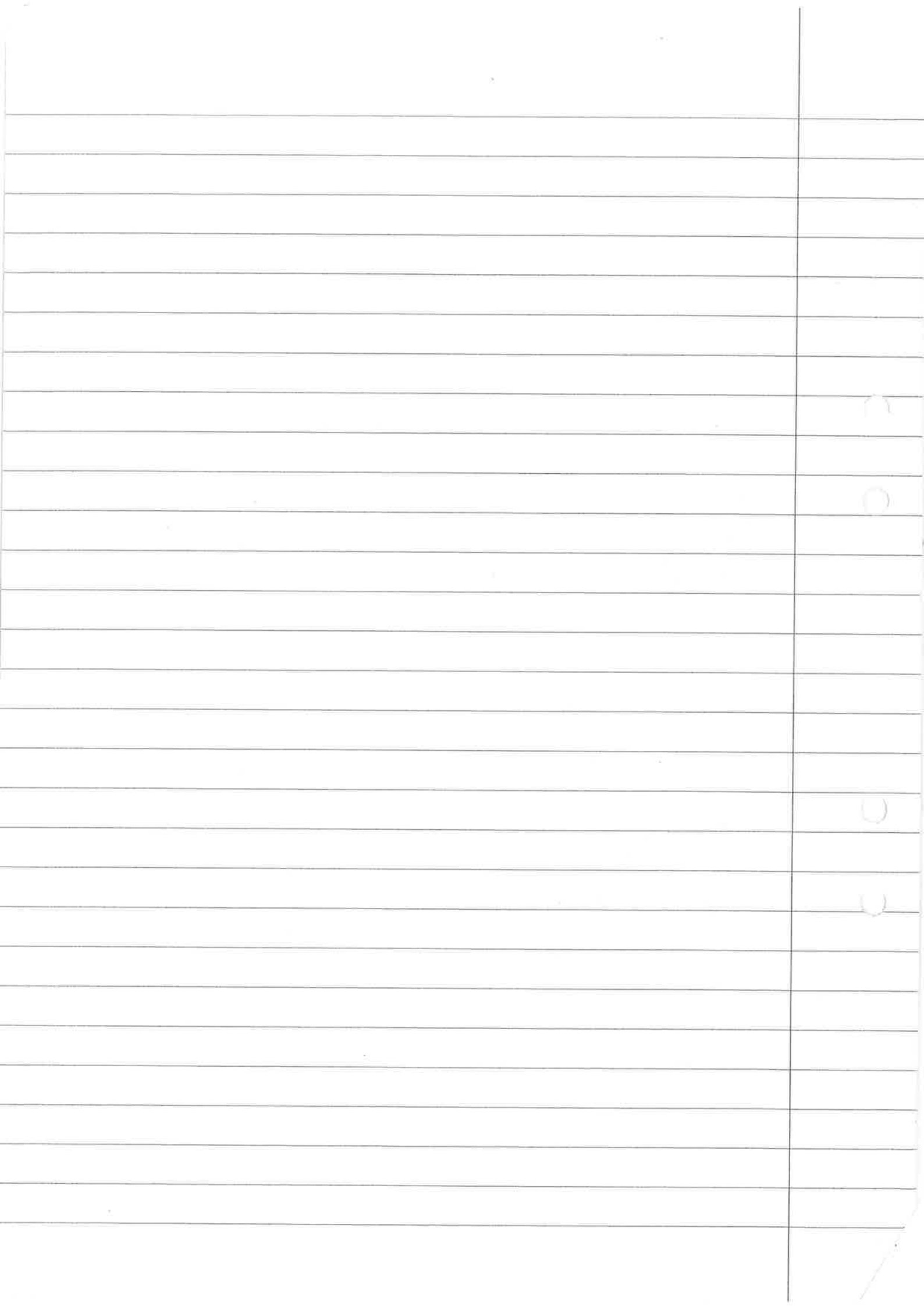
$$A_1 + A_0 = A_2$$

$$545,4545 + 5624,5 = 6219,9545 \text{ mm}^2$$

$$\frac{A_2}{\pi} = r^2 \Rightarrow \frac{6219,9545}{\pi} = 1979,87 = r^2$$

$$\sqrt{1979,87} = r = 44,5$$

$$44,5 \cdot 2 = yD = \underline{88,9 \text{ mm}}$$



(17) Formeln $\delta = \frac{F \cdot L}{E \cdot A}$

$$A = \frac{\pi (D^2 - d^2)}{4}$$

Givet: $F = 1,5 \cdot 10^3 \text{ (N)}$

$$D = 3 \text{ (mm)}$$

$$L = 4000 \text{ (mm)}$$

$$E = 3400 \text{ (N/mm}^2\text{)}$$

$$\delta = \frac{1,5 \cdot 10^3 \cdot 4000 \cdot 4}{3400 \cdot \pi (3^2)} = \frac{24\,000\,000}{96133} \approx 250$$

svar: 250 mm

Alicia Olavsson

20 Formeln $\delta = \frac{F \cdot L}{E \cdot A}$

$$A = \frac{\pi (D^2 - d^2)}{4}$$

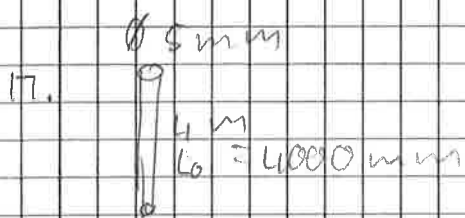
Given: $F = 120$ (N)
 $D = 5$ (mm)
 $L = 5000$ (mm)
 $\delta = 4,5$

$$4,5 = \frac{120 \cdot 5000 \cdot 4}{E \cdot \pi \cdot (5^2)}$$

$$E \cdot 4,5 \cdot \pi \cdot 25 = 120 \cdot 5000 \cdot 4$$

$$E \approx 6799 \approx 6800 \text{ N/mm}^2 = 6,8 \text{ kN/mm}^2$$

Alicia Olsson



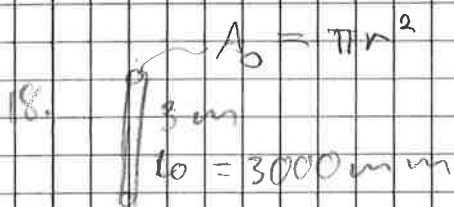
$$A = \pi \cdot r^2$$

$$= \pi \cdot 1,5^2$$

$$= 7,065 \text{ mm}^2$$

$$\sigma = \frac{l_0 \cdot F}{E \cdot A}$$

$$= \frac{4000 \cdot 15000}{3400 \cdot 7,065} = \frac{60\,000\,000}{24\,021\,000} \approx 2,50 \text{ (249,6)}$$



$$F = 4,7 \text{ kN} = 4700 \text{ N}$$

$$E = 2,1 \cdot 10^5 \text{ N/mm}^2$$

$$\sigma = 2,5 \text{ mm}$$

$$\sigma = \frac{F \cdot l_0}{E \cdot A}$$

$$A = \pi \cdot r^2$$

$$d = 2r$$

$$\sigma = \frac{F \cdot l_0}{E \cdot A}$$

$$A = \frac{F \cdot l_0}{E \cdot \sigma} = \frac{4700 \cdot 3000}{2,1 \cdot 10^5 \cdot 2,5}$$

$$A = 26,8 \approx 27$$

$$\pi r^2 = 26,8$$

$$r^2 = \frac{26,8}{\pi}$$

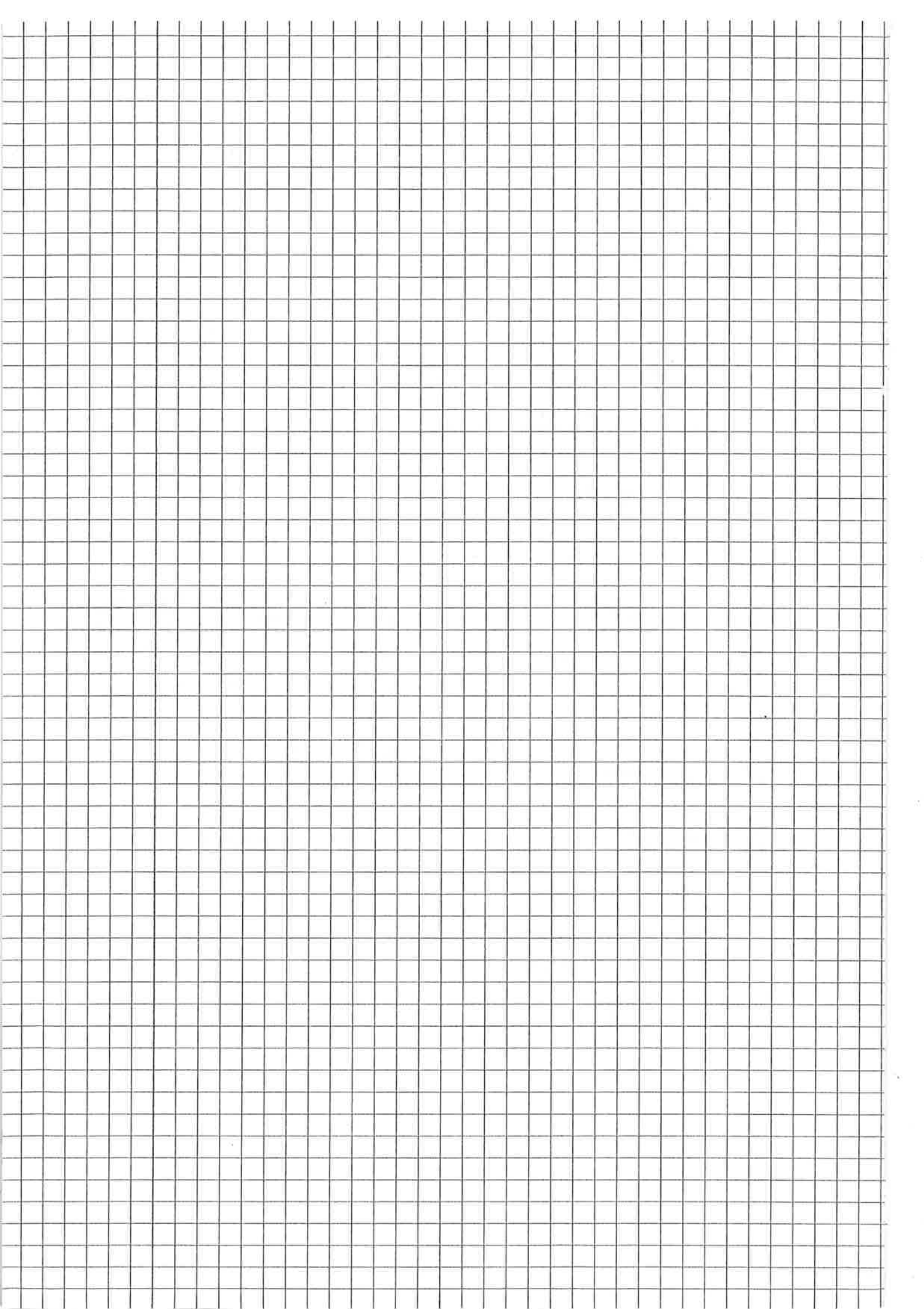
$$r^2 = \sqrt{\frac{26,8}{\pi}}$$

$$r^2 = 2,9$$

$$\text{Diam: } 2,9 \cdot 2 = 5,85$$

$$\approx 5,9$$

0^2



Elin

$$l_0, n = 234 \text{ st}$$

$$d = 0,4 \text{ mm} \rightarrow r = 0,2$$

$$m = 970 \text{ kg}$$

$$F = mg = \dots$$

$$E = 2,05 \cdot 10^5 \text{ N/mm}^2$$

$$\varepsilon = ?$$

$$\delta = 32 \text{ m}$$

$$L_0 = ?$$

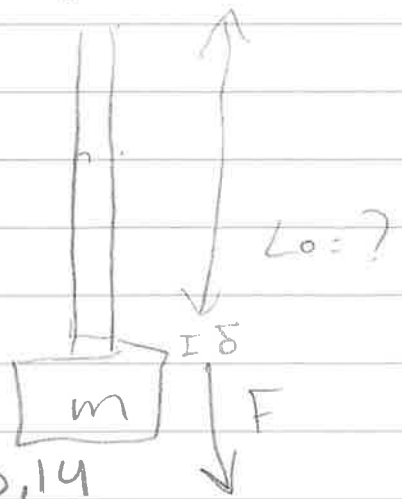
$$L_0 = \frac{\delta \cdot E \cdot A}{F} = \frac{32 \cdot 2,05 \cdot 10^5 \cdot 0,2^2 \cdot 3,14}{970 \cdot 9,81}$$

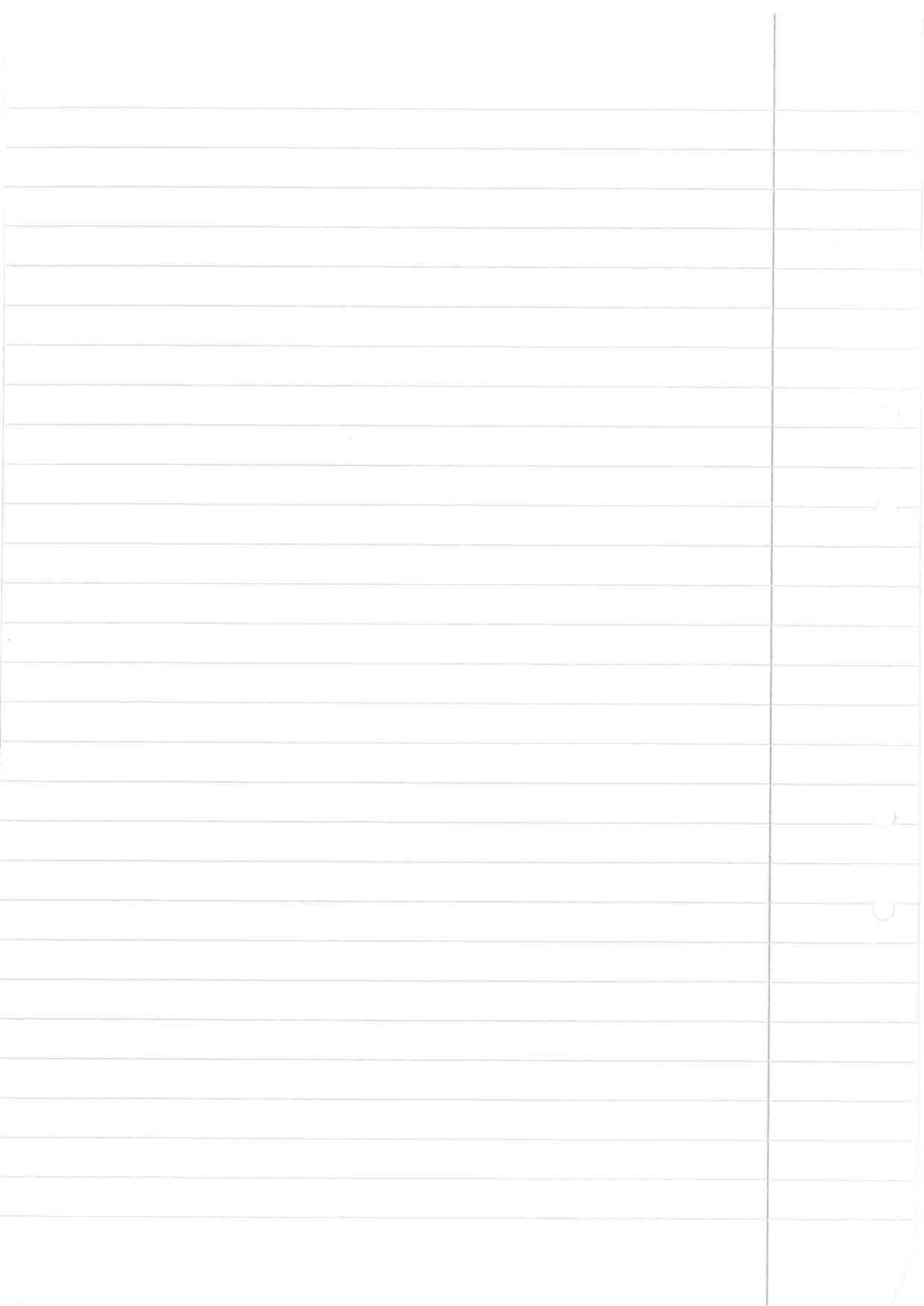
$$= 86,587$$

$$\varepsilon_{\text{tot}} = \frac{\delta}{L_0} = \frac{32}{86,587} = 0,3695$$

$$\varepsilon = \frac{\varepsilon_{\text{tot}}}{n} = \frac{0,3695}{234} = 0,00157 \approx 0,16\%$$

$$\text{OVAR. } \varepsilon = 0,16\%$$





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$$d = 6 \text{ mm} = 0,006 \text{ m} \quad l = 5 \text{ m}$$

$$m = 736 \text{ kg} \quad E_{\text{stål}} = 2,05 \cdot 10^5 \text{ N/mm}^2$$

Vi vill ha normalspänning (σ)
och förlängning (δ)

$$\sigma = \frac{F}{A} \quad F = 736 \cdot 9,82 = 7227,5 \text{ N}$$

$$\sigma = \frac{7227,5}{2,8,3} \quad A = \frac{6^2 \cdot \pi}{4} = 28,3$$

$$\sigma = 255 \text{ N/mm}^2$$

$$\delta = \frac{F \cdot l}{EA}$$

$$\delta = \frac{7227,5 \cdot 5}{2,05 \cdot 10^5 \cdot 2,8 \cdot 10^{-5}}$$

$$\delta = \frac{36137,5}{2,05 \cdot 2,8}$$

$$\delta = 6,2 \text{ mm}$$

Svar: Normalspänningen (σ) = 255 N/mm²

Förlängningen (δ) = 6 mm

$$14. \quad \frac{55000 \cdot 75}{450} = 916 \text{ mm}^2$$

$$916 = 55 \cdot x$$

$$x = 16,6 \text{ mm}$$

$$15. \quad 916 \text{ mm}^2$$

$$916 = x^2$$

$$\sqrt{916} = x$$

$$x = 30,3 \text{ mm}$$

$$16. \quad \frac{15000 \cdot 8}{220} = 545 \text{ mm}^2$$

$$545 = \frac{\pi}{4} (D^2 - 85^2)$$

$$D = 89 \text{ mm}$$

$$17. \quad \delta = \frac{4000 \cdot 1500}{3400 \cdot 7}$$

$$252 =$$

18.

22 längd x

örlänging 3x

$$A = 1,5^2 \cdot \pi$$

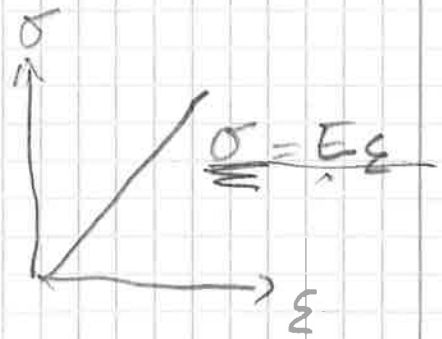
$$H = 7 \text{ mm}^2$$

$$F = 1 \cdot 9,81 = 9,81$$

$$\frac{9,81}{7} = 1,4$$

$$\frac{F}{A} = E \frac{\delta}{L}$$

$$1,4 = E \cdot \frac{2x}{3x}$$



$$\sigma = \frac{F}{A}$$

$$\epsilon = \frac{\delta}{L_0}$$

$$1,4 = \frac{3L_0}{L}$$

$$\frac{1,4}{3} = \frac{3L_0}{3}$$
$$0,46$$

23 $A = 20,5^2 \cdot \pi = 1320$

$$22,5^2 \cdot \pi = 1570,5$$

$$L = 2000$$

$$FL = -3,4 \text{ mm}$$

$$E = 3,4 \cdot 10^4 \text{ N/mm}^2 \cdot \frac{F}{270} = 578$$

$$\epsilon = \frac{\delta}{L_0} = \frac{3,4}{2000} = 0,0017$$

$$17 \quad F = 1500$$

$$D = \frac{3}{2} \cdot \pi \cdot A7$$

$$L = 4000 \text{ mm}$$

$$E = 3400$$

$$\delta = \frac{L \cdot F}{E \cdot A}$$

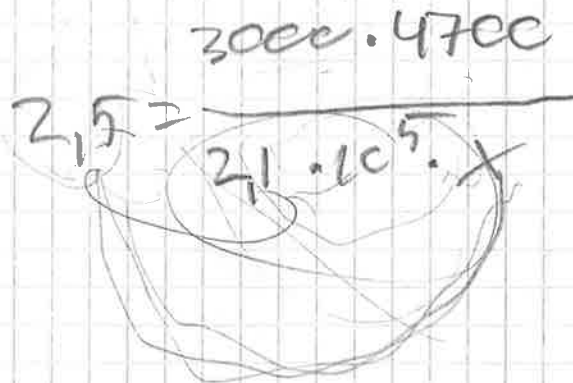
$$\frac{4000 \cdot 1500}{3400 \cdot 7} \approx 250 \quad \checkmark$$

$$L = 3000$$

$$\delta = 2,5$$

$$F = 4700$$

$$E = 21 \cdot 10^5$$

$$2,5 = \frac{3000 \cdot 4700}{21 \cdot 10^5 \cdot X}$$


$$21 \cdot 10^5 \cdot X = \frac{3000 \cdot 4700}{2,5}$$

24

50 m

3 mm diameter

7,85 kg/dm^3 densitet

$$d = 0,03 \text{ dm}$$



$$h \cdot r^2 \cdot \pi = V$$

$$500 \cdot 0,015^2 \cdot \pi = 0,353 \text{ dm}^3$$

$$0,353 \cdot 7,85 = 2,77 \text{ kg}$$

24

Givet: Längd 50 m = 500 dm

Diameter 3 mm = 0,03 dm

Densitet 7,85 kg/dm^3 Formler: $r^2 \pi = A$ (A = basarean)

$$A \cdot h = V$$

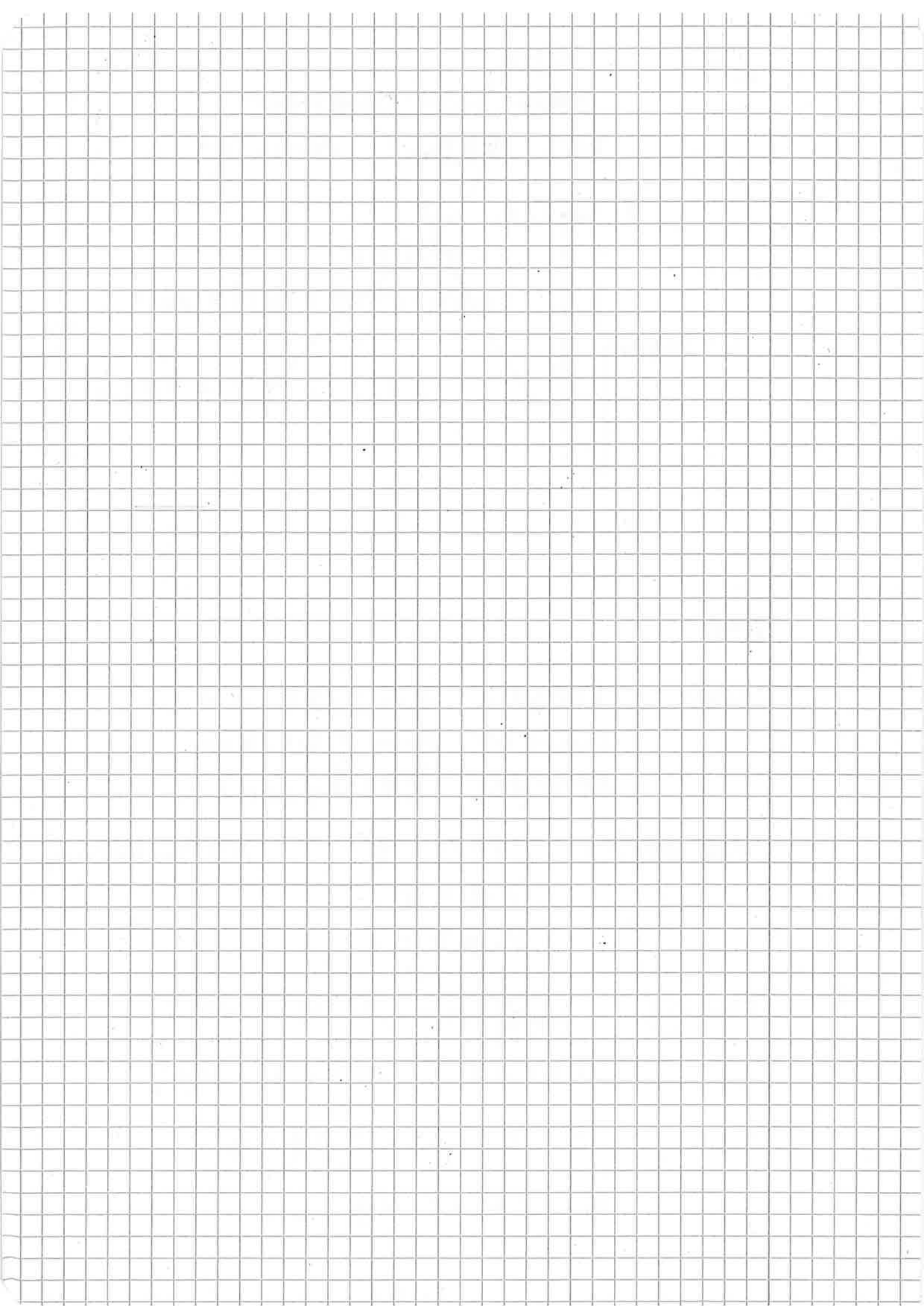
$$V \cdot \rho = m$$

$$\text{Lösning: } \left(\frac{0,03}{2}\right)^2 \cdot \pi = 7,07 \cdot 10^{-4} \text{ dm}^2$$

$$7,07 \cdot 10^{-4} \cdot 500 = 0,353 \text{ dm}^3$$

$$0,353 \cdot 7,85 = \underline{2,77 \text{ kg}}$$

Svar: 2,77 kg





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AB.

25.
$$\sigma = \frac{F + Q}{A}$$

~~4~~
$$\frac{4+2}{3} = 2$$

$$\frac{4+8}{2} = 6$$

$$\sigma = \frac{-Q}{A} = \frac{F}{A} \quad 15,3 \text{ kN}$$

$L = 1200000$ $Q = m \cdot g$ $m = V \cdot \rho$
 $n = 125$ $V = A \cdot L$ Kolla sidan 66
 $\rho = 7,85 \text{ kg/dm}^3$ $A = \pi \cdot r^2$

$$\sqrt{\frac{1,3}{2}} = 0,65$$

$$(\pi \cdot 0,65^2) = 1,327322896$$

$$125 \cdot 1,327322896 = 165,915362$$

$$165,915362 \cdot 1200000 = 199098434,4$$

$$199098434,4 \cdot 7,85 \text{ kg/dm}^3 = 1562922710$$

$$\cdot 9,81 = 1,5333227179 \cdot 10^3 \approx 15,3 \text{ kN}$$

1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9
10	10	10
11	11	11
12	12	12
13	13	13
14	14	14
15	15	15
16	16	16
17	17	17
18	18	18
19	19	19
20	20	20
21	21	21
22	22	22
23	23	23
24	24	24
25	25	25
26	26	26
27	27	27
28	28	28
29	29	29
30	30	30
31	31	31
32	32	32
33	33	33
34	34	34
35	35	35
36	36	36
37	37	37
38	38	38
39	39	39
40	40	40
41	41	41
42	42	42
43	43	43
44	44	44
45	45	45
46	46	46
47	47	47
48	48	48
49	49	49
50	50	50

29)

Givet: $F = 7200 \cdot 9.82 \text{ N}$

$D = 1500 \text{ mm}$

$d = 1300 \text{ mm}$

Formel: $A = \frac{\pi \cdot (D^2 - d^2)}{4}$

$R_m / \sigma_B = \frac{F}{A}$

Lösning: $A = \frac{\pi \cdot (1500^2 - 1300^2)}{4} = 439823$

$R_m = \frac{70704}{439823} = 0.16$

svar: 0.16 N/mm^2

