

Repetition 2.1-2.3 (ma 2c)

1. $3x - 18 = 3(x - 6)$

2. $(x - 2)(x + 8) = 0$

alt 1: $x_1 - 2 = 0$

$x_1 = 2$

alt 2: $x_2 + 8 = 0$

$x_2 = -8$

SVAR: $\begin{cases} x_1 = 2 \\ x_2 = -8 \end{cases}$

3. $x^2 + 6x = 0$

$x(x + 6) = 0$

$\begin{cases} x_1 = 0 & (\text{ger } 0 \cdot 6 = 0) \\ x_2 = -6 & (\text{ger } -6 \cdot 0 = 0) \end{cases}$

4. $x^2 - 16x + 63 = 0$ (pq-formeln)

$x = 8 \pm \sqrt{8^2 - 63}$

$x = 8 \pm 1$

$\begin{cases} x_1 = 9 \\ x_2 = 7 \end{cases}$

5. $2x^2 - 20x = -18$

$2x^2 - 20x + 18 = 0$

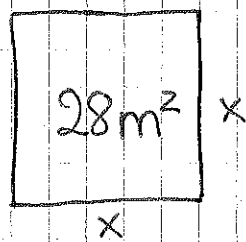
$x^2 - 10x + 9 = 0$

$x = 5 \pm \sqrt{5^2 - 9}$

$x = 5 \pm 4$

$\begin{cases} x_1 = 9 \\ x_2 = 1 \end{cases}$

6.



$$x^2 = 28$$

$$x = \sqrt{28} \quad \text{ty } x > 0$$

$$x \approx 5,3$$

$$\text{Omkrets} = 4x \approx 4 \cdot 5,3 = 21,2 \text{ m}$$

Svar: Det behövs ca 21,2 m

7.

$$z^2 + 25 = 0$$

$$z^2 = -25$$

$$z = \pm \sqrt{-25}$$

$$\underline{\underline{z = \pm 5i}}$$

8.

$$\text{a) } (x-4)^2 - 16 =$$

$$x^2 - 8x + 16 - 16 = \underline{\underline{x^2 - 8x}}$$

$$\text{b) } x(2x+5) - 2(3+x) =$$

$$2x^2 + 5x - (6 + 2x) =$$

$$2x^2 + 5x - 6 - 2x =$$

$$\underline{\underline{2x^2 + 3x - 6}}$$

9.

$$\text{a) } f(0) = -2$$

dvs y när $x=0$

$$\text{b) } f(x) = 0$$

dvs x när $y=0$

$$\begin{cases} x_1 = -1 \\ x_2 = 2 \end{cases}$$

$$\underline{\underline{\quad \quad \quad}}$$

10. $f(x)$: negativ x^2 -term: C & D

$$x=0 \Rightarrow y=-3 : C$$

SVAR: C

$g(x)$: positiv x^2 -term: A & B

$$x=0 \Rightarrow y=-3 : A \text{ \& } B$$

$$x=0,5 \Rightarrow y=10 \cdot 0,25 - 3 = -0,5 : B$$

SVAR: B

$h(x)$: negativ x^2 -term: C & D

$$x=0 \Rightarrow y=0 : D$$

SVAR: D

$p(x)$: positiv x^2 -term: A & B

$$x=1 \Rightarrow y=-2 : A$$

SVAR: A

11. $L = 0,006d^2$

a) $d = 30 \text{ cm}$ $L = ?$

$$L = 0,006 \cdot 30^2 = 0,006 \cdot 900 = \underline{\underline{5,4 \text{ ton}}}$$

b) $L = 18 \text{ ton}$ $d = ?$

$$0,006d^2 = 18$$

$$d^2 = 3000$$

$$\underline{\underline{d \approx 55 \text{ cm}}}$$

$$12. \quad z^2 + 4z + 5 = 0$$

$$z = -2 \pm \sqrt{(-2)^2 - 5}$$

$$z = -2 \pm \sqrt{-1}$$

$$z = -2 \pm i$$

$$13.a) \quad (x+2)(x-2) = \underline{\underline{x^2 - 4}}$$

$$(a+b)(a-b) = a^2 - b^2$$

$$b) \quad (x-6)^2 = x^2 - 12x + 36$$

$$(a-b)^2 = a^2 - 2ab + b^2$$

$$c) \quad (x-5)(x+5) - (x+5)^2 =$$

$$x^2 - 25 - (x^2 + 10x + 25) =$$

$$x^2 - 25 - x^2 - 10x - 25 = \underline{\underline{-10x - 50}}$$

$$14. \quad a) \quad 16 - x$$

$$b) \quad x(16-x) = f(x) = y$$

$$c) \quad x(16-x) = 0 \quad \text{ger nollställena}$$

$$\begin{cases} x_1 = 0 \\ x_2 = 16 \end{cases}$$

$$x_2 = 16$$

$$\text{Symmetri: } x = 8$$

$$y_{\max} = 8(16-8) = \underline{\underline{64}}$$

$$15. \quad \sqrt{6x+7} = x$$

$$6x+7 = x^2$$

$$x^2 - 6x - 7 = 0$$

$$x = 3 \pm \sqrt{3^2 + 7}$$

$$x = 3(\pm)4 \quad 3-4 \text{ förkastas ty } x > 0$$

$$\underline{\underline{x = 7}}$$

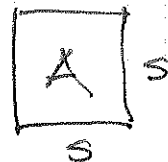
$$16. \quad 98 \cdot 102 =$$

$$(100-2)(100+2) =$$

$$10000 - 4 = \underline{\underline{9996}}$$

$$17. \quad A = 9x^2 + 6x + 1 = \quad A = s^2$$

$$= (3x+1)^2$$



SVAR: sidan är $3x+1$

$$18. \quad f(x) = x^2 + 2x - 15$$

a) min ty positiv x^2 -term

b) $f(x) = 0$ ger

$$x^2 + 2x - 15 = 0$$

$$x = -1 \pm \sqrt{1+15}$$

$$x = -1 \pm 4$$

Symmetrilinje : $x = -1$

$$c) \quad f(-1) = (-1)^2 + 2(-1) - 15 = 1 - 2 - 15 = \underline{\underline{-16}}$$

extrempunkt : $(-1, -16)$

$$d) \quad \text{nollställen : } x_1 = -5 \quad x_2 = 3$$

$$19. a) 10x - 25x^2 = \underline{\underline{5x(2-5x)}}$$

$$b) x^2 + 8x + 16 = \underline{\underline{(x+4)^2}}$$

$$c) \frac{18-2y^2}{3+y} = \frac{2(9-y^2)}{3+y} = \frac{2(3+y)(3-y)}{3+y} = \underline{\underline{2(3-y)}}$$

$$20. \text{ Total area: } A = 2x(8-x) = \textcircled{1}$$
$$= 16x - 4x^2 \quad \textcircled{2}$$

$$\text{Nollställen: } 2x(8-x) = 0$$
$$\begin{cases} x_1 = 0 \\ x_2 = 8 \end{cases}$$

$$\text{Symmetrilinje: } x = 4$$

Negativ x^2 -term ^{se ②} betyder att funktionen har maxpunkt för $x = 4$. (ins i ①)

$$A_{\max} = 2 \cdot 4(8-4) = 8 \cdot 4 = 32$$

SVAR: Största arean är 32 cm².

$$21. \quad A = 176 \text{ cm}^2 \quad \textcircled{1}$$

$$A = x(x-14) \quad \textcircled{2}$$

① & ② ger:

$$x(x-14) = 176$$

$$x^2 - 14x - 176 = 0$$

$$x = 7 \pm \sqrt{49 + 176}$$

$$x = 7 \pm \sqrt{225}$$

$$x = 7 \pm 15 \quad 7-15 \text{ förkastas ty } x > 0$$

$$x = 22$$

$$\text{andra sidan: } 22 - 14 = 8$$

SVAR: Sidorna är 22 resp. 8 cm.

$$\begin{array}{r} 11 \\ 176 \\ + 49 \\ \hline 225 \end{array}$$

$$22. \quad a) \quad \sqrt{4x+5} = x \quad \underline{x \geq 0}$$

$$4x+5 = x^2$$

$$x^2 - 4x - 5 = 0$$

$$x = 2 \pm \sqrt{4+5}$$

$$x = 2 \pm 3 \quad \text{ty } x \geq 0$$

$$\underline{x = 5}$$

$$b) \quad 3x^4 - 24x^2 - 27 = 0$$

$$x^4 - 8x^2 - 9 = 0$$

$$x^2 = 4 \pm \sqrt{16+9}$$

$$x^2 = 4 \pm 5$$

$$\underline{\text{fall 1}} \quad x^2 = 9$$

$$x = \pm 3$$

$$\begin{cases} x_1 = 3 \\ x_2 = -3 \end{cases}$$

$$\underline{\text{fall 2}} \quad x^2 = -1$$

$$x = \pm \sqrt{-1}$$

$$\begin{cases} x_3 = i \\ x_4 = -i \end{cases}$$

SVAR: $x_1 = 3$ $x_2 = -3$ $x_3 = i$ $x_4 = -i$

$$23. \quad a) \quad x^2 + 49 = 0$$

$$x^2 = -49$$

$$x = \pm \sqrt{-49}$$

$$\begin{cases} x_1 = 7i \\ x_2 = -7i \end{cases}$$

$$b) \quad 3x^2 + 8x = -7$$

$$3x^2 + 8x + 7 = 0$$

$$x^2 + \frac{8}{3}x + \frac{7}{3} = 0$$

$$x = -\frac{4}{3} \pm \sqrt{\frac{16}{9} - \frac{7}{3}}$$

$$x = -\frac{4}{3} \pm \sqrt{\frac{16}{9} - \frac{21}{9}}$$

$$x = -\frac{4}{3} \pm \frac{\sqrt{-5}}{3}$$

$$x = -\frac{4}{3} \pm \frac{\sqrt{5}i}{3}$$

$$\begin{cases} x_1 = \frac{-4 + \sqrt{5}i}{3} \\ x_2 = \frac{-4 - \sqrt{5}i}{3} \end{cases}$$

$$24. a) (x+5)(2x-8)=0$$

$$x_1 = -5$$

$$2x_2 - 8 = 0$$

$$2x_2 = 8$$

$$x_2 = 4$$

$$\begin{cases} x_1 = -5 \\ x_2 = 4 \end{cases}$$

$$b) \frac{1}{(x-2)^2} = 4$$

$$1 = 4(x-2)^2$$

$$1 = 4(x^2 - 4x + 4)$$

$$x^2 - 4x + 4 = \frac{1}{4}$$

$$x^2 - 4x + \frac{15}{4} = 0$$

$$x = 2 \pm \sqrt{4 - \frac{15}{4}}$$

$$x = 2 \pm \sqrt{\frac{16}{4} - \frac{15}{4}}$$

$$x = 2 \pm \frac{1}{2}$$

$$\begin{cases} x_1 = \frac{5}{2} & (x_1 = 2,5) \\ x_2 = \frac{3}{2} & (x_2 = 1,5) \end{cases}$$

25.

$$f(x) = ax^2 + 6x + 7$$

$$\text{vertex: } (b, 4) \quad x = b$$

$$\text{Nollställena: } ax^2 + 6x + 7 = 0$$

$$x^2 + \frac{6}{a}x + \frac{7}{a} = 0$$

$$x = -\frac{3}{a} \pm \sqrt{\frac{9}{a^2} - \frac{7}{a}}$$

Symmetrilinjen! sätt in

$$x = b, \text{ ger:}$$

$$-\frac{3}{a} = b \quad \therefore \underline{ab = -3} \quad \textcircled{1}$$

$$f(b) = 4 \quad (\text{enl. vertex})$$

$$ab^2 + 6b + 7 = 4$$

$$ab \cdot b + 6b + 7 = 4 \quad \textcircled{1} \text{ insättes}$$

$$-3b + 6b + 7 = 4$$

$$3b = -3$$

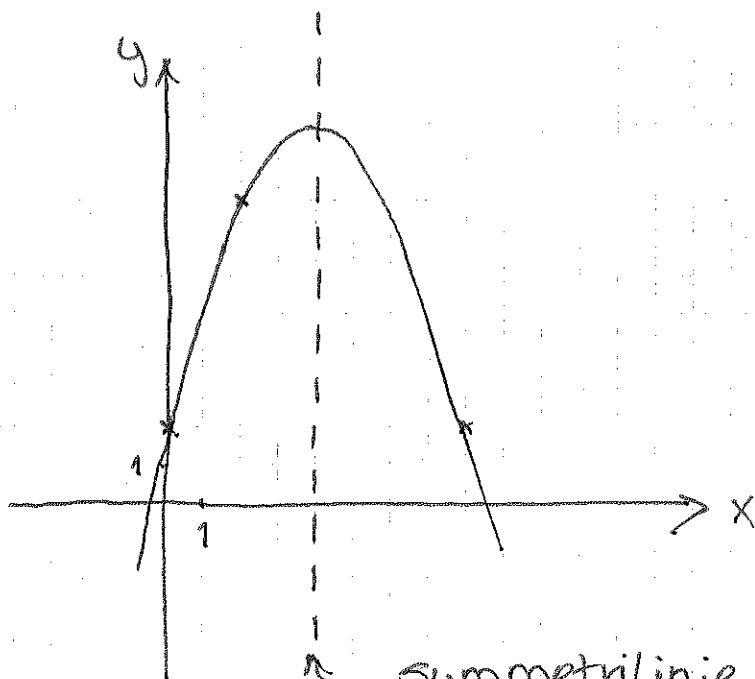
$$\underline{b = -1} \quad \text{sätt in i } \textcircled{1} \text{ ger:}$$

$$a \cdot (-1) = -3$$

$$\underline{a = 3}$$

$$\underline{\text{SVAR:}} \quad a = 3 \quad \& \quad b = -1$$

26.



symmetrilinje $x=4$ ges av punkterna $(0,2)$ & $(8,2)$

Måste ha maxpunkt för att gå genom givna punkter. \therefore negativ x^2 -term

$$f(x) = -ax^2 + bx + c \quad \textcircled{1}$$

Nollställena: $-ax^2 + bx + c = 0$

$$x^2 - \frac{bx}{a} + \frac{c}{a} = 0$$

$$x = \frac{b}{2a} \pm \sqrt{\frac{b^2}{4a^2} - \frac{c}{a}}$$

symmetrilinjen $x=4$

$$\therefore \frac{b}{2a} = 4 \quad \textcircled{2}$$

$$\underline{b=8a} \quad \leftarrow \text{ins. i } \textcircled{1}$$

$$f(x) = -ax^2 + 8ax + c$$

$$f(0) = 2 \quad (\text{enl. punkt } (0,2))$$

$$0 + 0 + c = 2$$

$$\underline{c=2}$$

$$\therefore f(x) = -ax^2 + 8ax + 2$$

forts
→

forts.

26.

$$f(x) = -ax^2 + 8ax + 2$$

$$f(2) = 8 \text{ ger:}$$

$$-4a + 16a + 2 = 8$$

$$12a = 6$$

$$\underline{a = 0,5}$$

ins. i (2) ger:

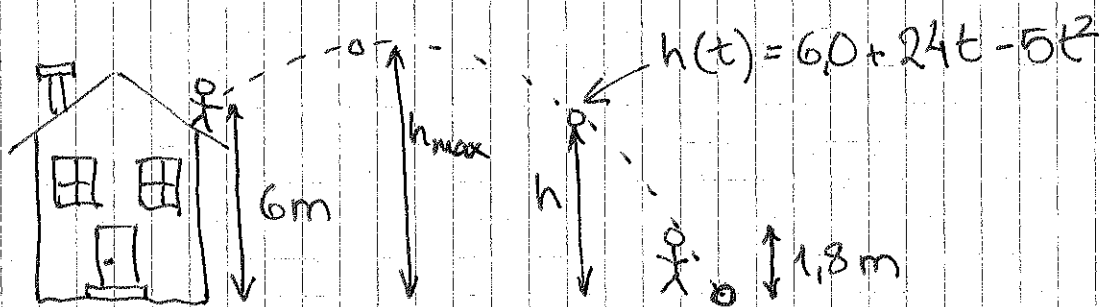
$$b = 8a$$

$$\underline{b = 4}$$

SVAR: Sökt funktion är

$$f(x) = -0,5x^2 + 4x + 2$$

27.



a) $t = ?$ vid h_{max} $h_{max} = ?$

Söker symmetrilinjen:

$$h(0) = 6$$

$$h(t) = 6 \quad 6 + 24t - 5t^2 = 6$$

$$24t - 5t^2 = 0$$

$$t(24 - 5t) = 0$$

$$t_1 = 0 \text{ (känd)}$$

$$t_2 = \frac{24}{5} \text{ s} = \underline{\underline{4,8 \text{ s}}}$$

forts

forts.

27a) Vi har nu $h(0)=6$ och $h(4,8)=6$
Symmetrilinjen ligger i mitten av dessa
tidpunkter, alltså $t=2,4$ s vid h_{\max}

$$h_{\max} = h(2,4) = 6 + 24 \cdot 2,4 - 5 \cdot 2,4^2 = \\ = 34,8 \text{ m} \approx 35 \text{ m}$$

SVAR: Maxhöjden 35m nås efter 2,4s

b) $h=1,8$ m $t=?$

$$6 + 24t - 5t^2 = 1,8$$

$$4,2 + 24t - 5t^2 = 0$$

$$5t^2 - 24t - 4,2 = 0$$

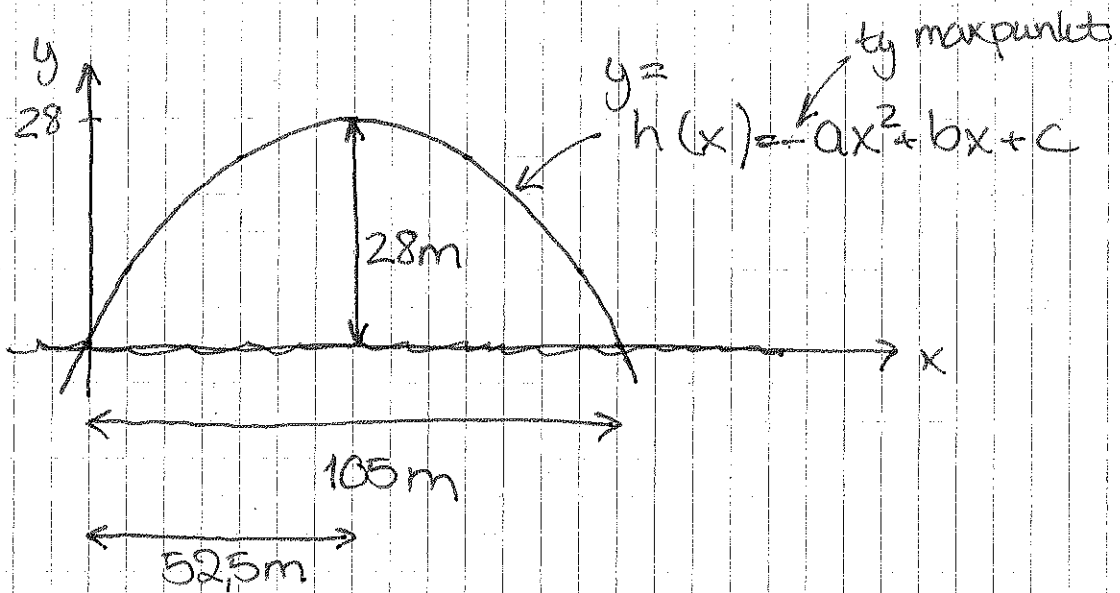
$$t^2 - 4,8t - 0,84 = 0$$

$$t = 2,4 \pm \sqrt{2,4^2 + 0,84}$$

$$t \approx 5,0 \text{ s} \quad (t \text{ y } t > 0)$$

SVAR: Man får stenen i kverudet
efter 5 s.

28.



$$h(0) = 0$$

$$h(105) = 0$$

$$h(52,5) = 28$$

Nullställe ger: $-ax^2 + bx + c = 0$

$$x^2 - \frac{b}{a}x + \frac{c}{a} = 0$$

$$x = \frac{b}{2a} \pm \sqrt{\left(\frac{b}{2a}\right)^2 + \frac{c}{a}}$$

Symmetri $x = 52,5$

ger $b = 105a$

$$h(0) = 0 \Rightarrow c = 0$$

$$h(52,5) = 28 \Rightarrow -a \cdot 52,5^2 + 105a \cdot 52,5 = 28$$

$$2756,25a = 28$$

$$a \approx 0,010 \Rightarrow b \approx 1,07$$

SVAR: $h(x) = -0,010x^2 + 1,07x$

om vi placerar origo vid vänstra brofästet.