(11.) $f(x) = x^3 - 6x^2 - 15x - 2$

Polynomina jatkuva ja derivoituva.

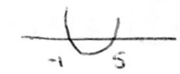
$f'(x) = 3x^2 - 12x - 15$

$f'(x) = 0$

$3x^2 - 12x - 15 = 0$

$x = -1$ tai $x = 5$

		-1		5	
$f'(x)$	+		−		+
$f(x)$	↗		↘		↗
		max		min	



Ääriarvokohdat:

max: $x = -1$

min: $x = 5$

Ääriarvot:

max: $f(-1) = (-1)^3 - 6\cdot(-1)^2 - 15\cdot(-1) - 2 = 6$

min: $f(5) = -102$

(12.)

Ympärysmitta: 12,0 m

$\frac{1}{2}\cdot 2\pi r + a + 2r + a = 12$

$\pi r + 2r + 2a = 12$

$2a = 12 - \pi r - 2r$

$a = \frac{12 - \pi r - 2r}{2}$

$A(r) = \frac{1}{2}\pi r^2 + 2r\cdot a = \frac{1}{2}\pi r^2 + 2r\,\frac{12 - \pi r - 2r}{2}$

$= \frac{1}{2}\pi r^2 + 12r - \pi r^2 - 2r^2 = -\frac{1}{2}\pi r^2 - 2r^2 + 12r$

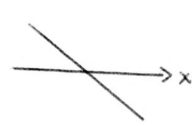
$A'(r) = -\frac{1}{2}\pi\cdot 2r - 2\cdot 2r + 12 = (-\pi - 4)r + 12{,}0$

$A'(r) = 0$

$(-\pi - 4)r + 12{,}0 = 0$

$r = \frac{-12}{-\pi - 4} = \frac{12}{\pi + 4} = 1{,}680\ldots \approx 1{,}68$

	0		1,68...	
$A'(r)$		+		−
$A(r)$		↗		↘
			max	



Ikkunan pinta-ala on suurin, kun $r = \frac{12}{\pi+4} \approx 1{,}68$.

$a = \frac{12 - \pi r - 2r}{2} = 6 - \left(\frac{\pi}{2} + 1\right)r = 6 - \left(\frac{\pi}{2} + 1\right)\cdot\frac{12}{\pi + 4}$

$= 6 - \frac{\pi + 2}{\cancel{2}_{1}}\cdot\frac{\cancel{12}^{6}}{\pi + 4} = 6 - \frac{6\pi + 12}{\pi + 4} = \frac{6\pi + 24}{\pi + 4} - \frac{6\pi + 12}{\pi + 4}$

$= \frac{12}{\pi + 4}\ (= r)$

$A_{max} = A\left(\frac{12}{\pi+4}\right) = \left(-\frac{1}{2}\pi - 2\right)\left(\frac{12}{\pi+4}\right)^2 + 12\cdot\frac{12}{\pi+4} = 10{,}081\ldots \approx 10{,}1\ (m^2)$