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2 Find the set of values of the constant k for which the curve $y=-x^2+(1-k)x-2$ lies entirely below the line $x+y=0$. [4]

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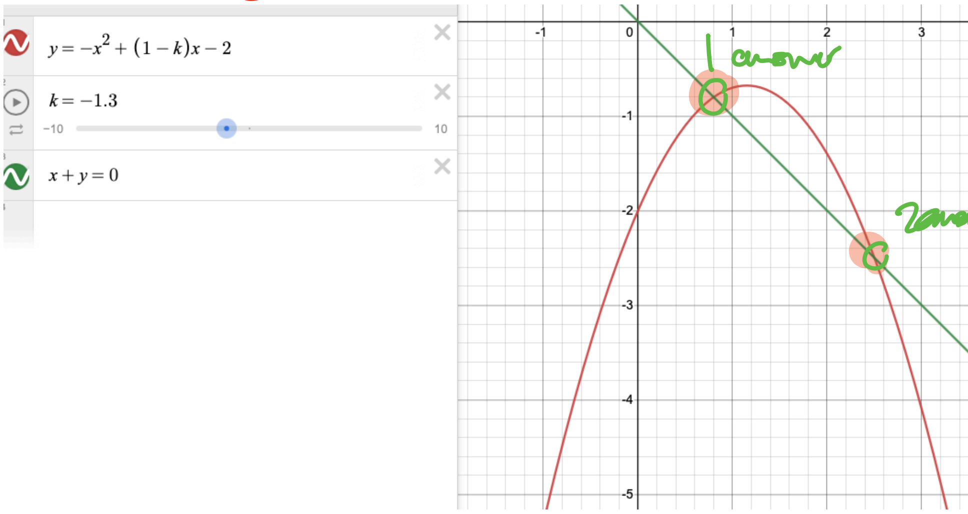
Case ① $D>0$

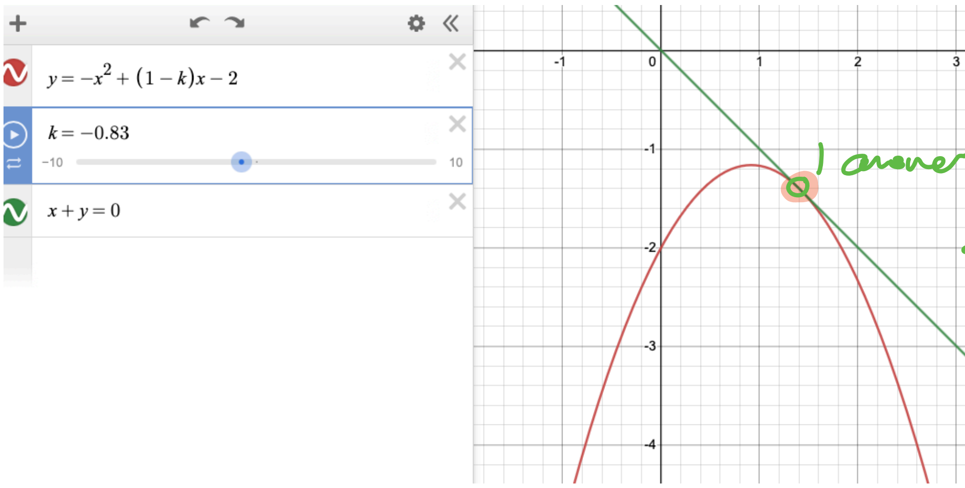


Explanation:

to lie below the line $x+y=0$, we need to see case ③

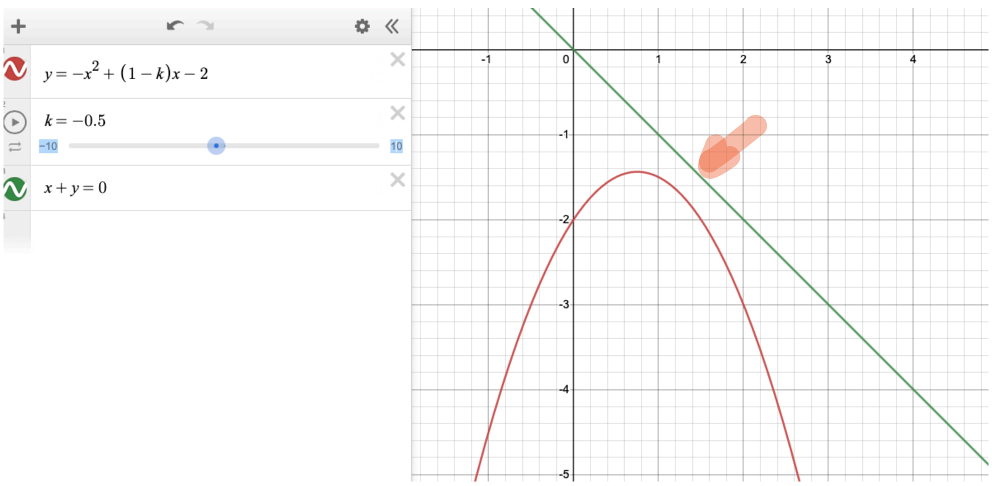
→ there is 2 answers for this case ① so $D>0$

Case ② $D=0$



→ there is 1 answer for this case ② so $D=0$

Case ③ $D<0$



→ there is 0 answers for this case ③

so $D<0$

↓

which makes the graph go below.

∴ we want this!!

↓ solution

Anderson S4 2020 SA2 A Math P1 Q2

2 Find the set of values of the constant k for which the curve $y = -x^2 + (1-k)x - 2$ lies entirely below the line $x + y = 0$. [4]

Given $x + y = 0$

$y = -x$ — ①

Sub ① into $y = -x^2 + (1-k)x - 2$

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

$x^2 + (k-2)x + 2 = 0$

a b c

$D < 0$

∴ Case ③

$D < 0$

does not touch and below

$b^2 - 4ac < 0$

$(k-2)^2 - 4(1)(2) < 0$

$k^2 - 4k + 4 - 8 < 0$

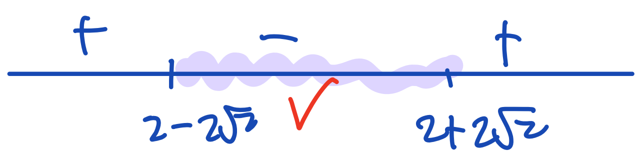
$k^2 - 4k - 4 < 0$

$k = \frac{4 \pm \sqrt{4^2 - 4(1)(-4)}}{2}$

$= \frac{4 \pm \sqrt{32}}{2}$

$= \frac{4 \pm 4\sqrt{2}}{2}$

$= 2 \pm 2\sqrt{2}$



$2 - 2\sqrt{2} < k < 2 + 2\sqrt{2}$ // Ans.