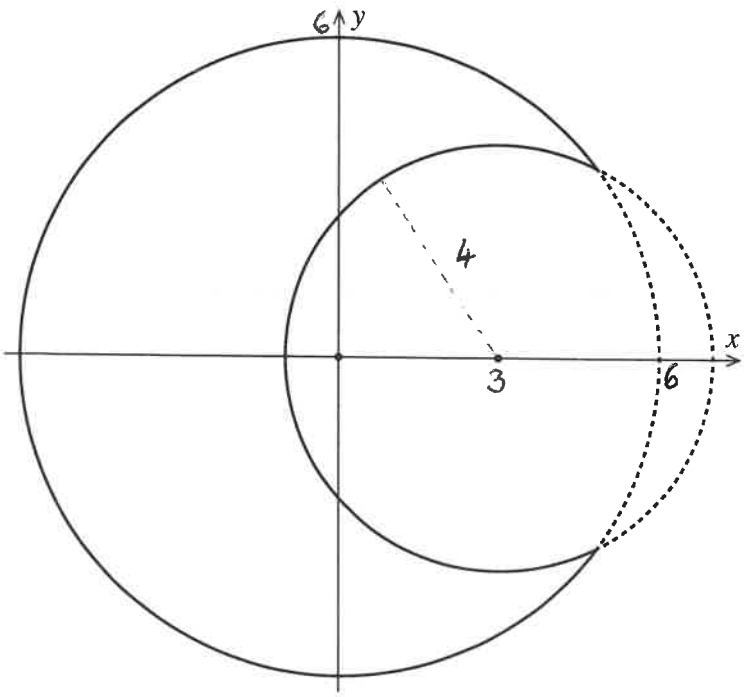
The crescent shaped domain D below is bounded by portions of circles of radius 6 and 4 respectively. Their centers are distance 3 apart. Calculate $\iint_D xy^2\,dA$. Hints:

(a) While D is neither horizontally nor vertically simple, you can write $D = D_+ \cup D_-$, where D_+ and D_- are the parts of D above and below the x-axis, and they are vertically simple.
Determine functions $g_1(x)$, $g_2(x)$ s.t. $D_+ = \{(x,y) : g_1(x) \le y \le g_2(x)\}$
Note that g_1 will be a piecewise function $g_1(x) = \begin{cases} \dots & \text{if } x \le \dots \\ \dots & \text{if } x \ge \dots \end{cases}$

(b) Find out the smallest x (easy)
and the largest x (from intersection of two circles)
to determine the limits of integration in $\int_?^? \dots dx$

(c) You will split $\int_?^? \dots dx$ into two pieces
$\int_?^? \dots dx + \int_?^? \dots dx$ according to where the formula for g_1 changes.



(d) Once you have reduced
$\iint_D xy^2\,dA$ to single variable integrals $\int_a^b \dots dx + \int_b^c \dots dx$
you are welcome to use symbolic algebra software or numerical methods (Wolfram-Alpha, Mathematica, Maple, Matlab, ...)
to finish it up (even though it can be done by Calc 2 methods if need be)