Use the constants a, b and c of your ID

I. **(12 Points)** Answer the following questions:

(a) Find using Taylor Series the following limit

$$\lim_{x\to 0} \frac{\sin(ax) - ax\cos(bx)}{bxe^{ax} - bx - abx^2}.$$

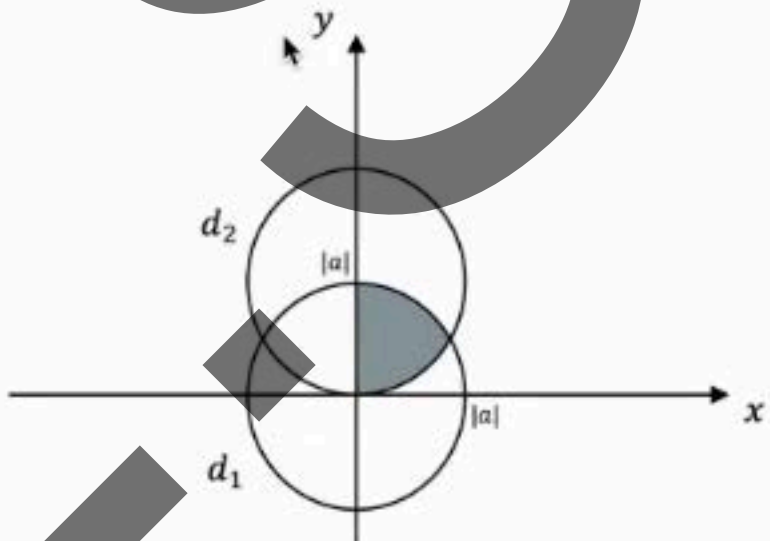
IV. **(15 Points)** Let d_1 be the disk of center $(0,0)$ and of radius $|a|$ and d_2 the disk of center $(0,|a|)$ and of radius $|a|$.

Let D be the part of the region of intersection of d_1 and d_2 situated in the first quadrant (see the figure below).

(a) Define the region D using cartesian and polar coordinates.

(b) Find the double integral

$$\iint_D \sqrt{x^2+y^2}\,dxdy.$$



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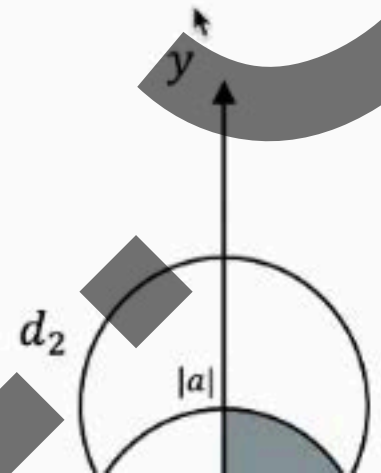

Use the constants a, b and c of your ID

III. **(12 Points)** Consider the polynomial $p(n) = an^2 + bn + c$ and the power series

$$S = \sum_{n=0}^{\infty} \frac{p(n)}{n!} x^n.$$

(a) Study the convergence of S.

(b) Show that $p(n)$ can be written as $p(n) = a'n(n-1) + b'n + c'$, where a', b' and c' are three real numbers to be found.

(c) Deduce the value of S in terms of x.

(b) Study the convergence of the following power series and find its sum in terms of x:

$$\sum_{n=0}^{\infty} \cosh(an) x^n.$$

(b) Study the convergence of the following power series and find its sum in terms of x:

(a) $\sum_{n=0}^{\infty} \cosh(an)x^n$.

Use the constants a, b and c of your ID

II. **(12 Points)** Answer the following questions:

(a) Find the first 3 terms of the Maclaurin series of the function:

(a) $f(x) = e^x \cos^2(ax)$.

Use the constants a, b and c of your ID

II. **(12 Points)** Answer the following questions:

(a) Find the first 3 terms of the Maclaurin series of the function:

(a) $f(x) = e^x \cos^2(ax)$.

(b) Find the double integral

$$\iint_D \frac{|b|}{(|b|x + |c|y + 1)^2}\, dxdy$$

where $D = \{(x, y) \in \mathbb{R}^2 \mid 0 \leq x \leq 1\,,\ 0 \leq y \leq 1\}$.