1 | **Electric Change**

We are finally taking a surface integral! This is essentially multiplying the surface area of the shape of the function to the value of the function itself.

Firstly, taking the area dA by dV:

$$
\begin{aligned}
dA &= \sqrt{1 + \left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2} && (1)\\
&= \sqrt{1 + (3)^2 + (2)^2} && (2)\\
&= \sqrt{14} && (3)
\end{aligned}
$$

Supplying the value into the function:

$$
\begin{aligned}
&\int_0^7 \int_0^{11} (3x + 2y + 7)\sqrt{14}\; dy\; dx && (4)\\
\Rightarrow &\sqrt{14} \int_0^7 \int_0^{11} (3x + 2y + 7)\; dy\; dx && (5)\\
\Rightarrow &\sqrt{14} \int_0^7 \left(3xy + y^2 + 7y\right)\Big|_0^{11}\; dy\; dx && (6)\\
\Rightarrow &\sqrt{14} \left(\frac{33x^2}{2} + 198x\right)\Bigg|_0^7 && (7)\\
\Rightarrow &\frac{4389\sqrt{14}}{2} && (8)
\end{aligned}
$$

The charge, therefore, is proportional to $\frac{4389\sqrt{14}}{2}\rho$.

2 | **Infinite wire**

Recall first that a semicircle with radius 7 can be defined as:

$$
\begin{aligned}
y &= \sqrt{7^2 - x^2} && (9)\\
&= \sqrt{49 - x^2} && (10)
\end{aligned}
$$

Let's first figure the value of this function dA:

$$
\begin{aligned}
dA &= \sqrt{1 + \frac{d}{dx}\sqrt{49 - x^2}} && (11)\\
&= \sqrt{1 + \frac{d}{dx}\sqrt{49 - x^2}} && (12)\\
&= \sqrt{1 - \frac{x}{\sqrt{-x^2 + 19}}} && (13)
\end{aligned}
$$

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f(x) = sqrt(49-x^2)
f.diff()
```

We will take the line integral of this function, and proceed to multiply by the value of xy at that point.

$$\int_0^7 \int_0^7 xy\,\sqrt{49 - x^2}\;dx\;dy \tag{14}$$