1 Find $\displaystyle\int \frac{\sqrt{x^2 + 16}}{x^4}\, dx$.

**2** Find the arc length of the portion of the graph of

$$f(x) = 2\sqrt{e^x - 1} - 2\arctan\left(\sqrt{e^x - 1}\right)$$

which lies between the vertical lines $x = 0$ and $x = \ln 4$. Express your answer as an integer.

3 Find the area of the region below, where the curve is the graph of the polar equation

$$r = 5 + \sin(x) + \sin(3x) + 3\cos(3x).$$

(Note: you have some tricks up your sleeve for calculating the integral you need to calculate—you do not have to do it all out by hand.)
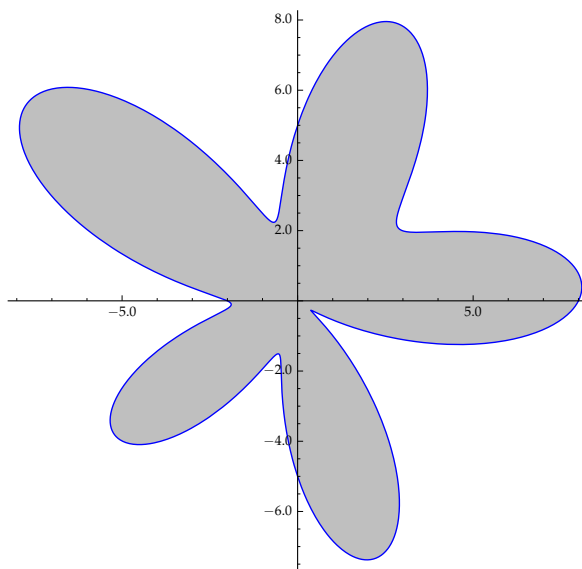
4 How much work does it take to move an object in the presence of a force $F(x) = \sqrt{x}$ from the location $x = 0$ to the location $x = 1$?

5 Find complex numbers z and w such that

$$2z + (3+i)w = 3+i$$
$$z + 2w = 2+i.$$

6 Find f such that $f''(x) + 3f'(x) + 2f(x) = 0$ and $f(0) = 5$ and $f'(0) = -5$.