1 Introduction

2 B1

1.

$$
\begin{aligned}
\langle nlm|r|n'l'm'\rangle &= \int \psi^{\dagger}_{nlm}(\mathbf{r}) r \psi_{n'l'm'}(\mathbf{r}) r^2 sin\theta dr d\theta d\phi \\
\langle nlm|r|n'l'm'\rangle &= \int \frac{P^*_{nl}(r)}{r} r \frac{P_{n'l'}(r)}{r} r^2 dr \int_0^{\pi} \int_0^{2\pi} Y^*_{lm}(\theta,\phi) Y_{l'm'}(\theta,\phi) \sin\theta d\theta d\phi \\
\langle nlm|r|n'l'm'\rangle &= \int P^*_{nl}(r) r P_{n'l'}(r) dr \, (\delta_{ll'}\delta_{mm'}) \\
\langle nlm|r|n'l'm'\rangle &= \int P^*_{nl}(r) r P_{n'l'}(r) dr
\end{aligned}
$$

Where we make use of the of the orthagonal spherical components.

Thus, the problem reduces to solving the radial equation (6), which depends on the potential V ,

2

3 ...

You can see my plot in Fig. 1.

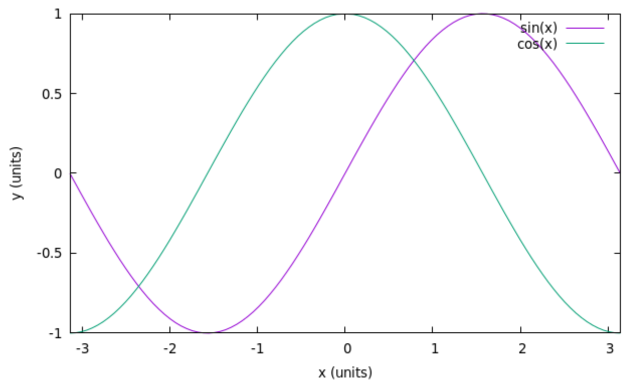

Figure 1: Caption for the plot

4 B5

You can add code snippets like this:

```
double f(double x) {
    std::cout << "Hello world\n";
    return std::exp(-x) * std::sin(5.0 * x);
}
```

5 Conclusion