

0) Have you taken the prerequisite math courses?

These are: coregistration in at least MATH 294 (linear algebra) or equivalent. MATH 294 has the prerequisite MATH 192, covering polar coordinates, infinite series, and power series, vectors and calculus of functions of several variables, double and triple integrals.

Result: 85% yes, 12% don't know, 3% no.

1) Use complex numbers to derive the following equation: $\sin(2\alpha) = 2 \sin(\alpha) \cos(\alpha)$.

Solution: $\sin(2\alpha) = \frac{e^{i2\alpha} - e^{-i2\alpha}}{2i} = \frac{(e^{i\alpha} - e^{-i\alpha})(e^{i\alpha} + e^{-i\alpha})}{2i} = 2 \frac{e^{i2\alpha} - e^{-i2\alpha}}{2i} \frac{e^{i2\alpha} + e^{-i2\alpha}}{2} = 2 \sin(\alpha) \cos(\alpha)$.

Result: 42% correct, 58% wrong.

2) What is the general solution of the following ODE: $x'' = kx$ for $k < 0$ and for $k > 0$?

Solution: For $k < 0$ it is $x = A \cos(\sqrt{|k|}t) + B \sin(\sqrt{|k|}t)$. For $k > 0$ it is $x = A \cosh(\sqrt{k}t) + B \sinh(\sqrt{k}t)$.

Result: 24% correct, 76% wrong.

3) What is $5e^{i\pi/2} \cdot 3e^{-i\pi/4}$?

Solution: $15e^{i\pi/4}$.

Result: 67% correct, 33% wrong.

4) What is $5e^{i\pi/2} + 3e^{-i\pi/4}$?

Solution: $5e^{i\pi/2} + 3e^{-i\pi/4} = 5i + \frac{3}{\sqrt{2}}(1 - i) = \frac{3}{\sqrt{2}} + i\frac{5\sqrt{2}-3}{\sqrt{2}}$.

Result: 27% correct, 73% wrong.

5) Solve the following indefinite integral: $\int \frac{1}{x} dx$.

Solution: $\ln x + C$.

Result: 85% correct, 15% wrong.

6) Solve the following integral: $\int_0^\pi \cos^2 \phi \sin \phi d\phi$.

Solution: $\int_0^\pi \cos^2 \phi \sin \phi d\phi = -\int_1^{-1} \cos^2 \phi d(\cos \phi) = \int_{-1}^1 x^2 dx = \frac{2}{3}$.

Result: 36% correct, 64% wrong.