

0) Do you have the math requirements?

Math190 or 191: analytic geometry, differential and integral calculus

Math192: vectors and calculus of functions of several variables through double and triple integrals

Co-registration in at least Math294: Linear algebra

Result: 76% yes, 22% no answer, 2% 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: 27% correct, 73% 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 $x = A \cosh(\sqrt{kt}) + B \sinh(\sqrt{kt})$.

Result: 6% correct, 94% wrong.

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

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

Result: 65% correct, 35% wrong.

4) What is the real and imaginary part of $5e^{i\pi/2} + 3e^{-i\pi/4}$?

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: 20% correct, 80% wrong.

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

Solution: $\ln x + C$.

Result: 90% correct, 10% 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: 43% correct, 57% wrong.