

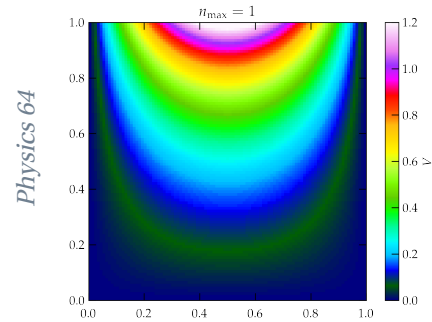
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## Midterm Examination 2

31 March 2026

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Name \_\_\_\_\_



1. Time: 75 minutes
2. No books, notes, calculators, or computers.
3. Three problems of unequal weight for a total of 100 points.
4. *Read through the whole exam before starting.* Work carefully, check your algebra, and explain what you are doing with brief English phrases.
5. This test is given under the HMC Honor Code.
6. If you don't understand what a question is asking, please ask for clarification.

*Good luck, everyone!*

I will respect the HMC Honor Code in taking this exam

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*signed*

$$\Gamma(x+1) = \int_0^\infty t^x e^{-t} dt \quad \Gamma(n+1) = n\Gamma(n) \quad \Gamma\left(\frac{1}{2}\right) = \sqrt{\pi} \quad (a+b)^n = \sum_{i=0}^n \binom{n}{i} a^{n-i} b^i$$
$$e \approx 2.718 \quad e^{i\phi} = \cos \phi + i \sin \phi \quad \cos \phi = \frac{e^{i\phi} + e^{-i\phi}}{2} \quad \sin \phi = \frac{e^{i\phi} - e^{-i\phi}}{2i}$$
$$\sin(a \pm b) = \sin a \cos b \pm \cos a \sin b \quad \cos(a \pm b) = \cos a \cos b \mp \sin a \sin b$$
$$\sum_{n=0}^{N-1} \rho^n = \frac{1 - \rho^N}{1 - \rho} \quad \frac{1}{1-x} = 1 + x + x^2 + x^3 + \dots \quad |x| < 1$$
$$(1+x)^n = 1 + nx + \frac{n(n-1)}{2!}x^2 + \frac{n(n-1)(n-2)}{3!}x^3 + \dots$$
$$\oint f(z) dz = 2\pi i \sum_n a_{-1}(z_n) \quad a_{-1}(z_0) = \lim_{z \rightarrow z_0} \frac{1}{(v-1)!} \frac{d^{v-1}}{dz^{v-1}} [f(z)(z-z_0)^v]$$
$$\tilde{f}(\omega) = \int_{-\infty}^{\infty} f(t) e^{i\omega t} dt \quad f(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} \tilde{f}(\omega) e^{-i\omega t} d\omega \quad \delta(x) = \frac{1}{2\pi} \int_{-\infty}^{\infty} e^{ikx} dk$$
$$\int_{-\infty}^{\infty} e^{-\alpha x^2 - \beta x - \gamma} dx = \sqrt{\frac{\pi}{\alpha}} e^{\beta^2/4\alpha - \gamma}$$