

WRITTEN PRELIM EXAM

Answer all five questions. Start each answer on a new page.

In the upper right hand corner of each sheet you hand in, put your code number (NO NAMES PLEASE) and the problem number. Staple together all sheets for a given problem.

Insert your answers into the manila envelope supplied.

The following are some helpful items:

$h = 6.625 \times 10^{-34} \text{ J} \cdot \text{s} = 4.134 \times 10^{-15} \text{ eV} \cdot \text{s}$	$\nabla(\phi + \psi) = \nabla\phi + \nabla\psi$
$e = 1.6 \times 10^{-19} \text{ C}$	$\nabla\phi\psi = \phi\nabla\psi + \psi\nabla\phi$
$c = 3.0 \times 10^8 \text{ m/s}$	$\nabla \cdot (\mathbf{F} + \mathbf{G}) = \nabla \cdot \mathbf{F} + \nabla \cdot \mathbf{G}$
$k_B = 1.38 \times 10^{-23} \text{ J/K}$	$\nabla \times (\mathbf{F} + \mathbf{G}) = \nabla \times \mathbf{F} + \nabla \times \mathbf{G}$
$\sigma = 5.67 \times 10^{-8} \text{ W/K}^4 \cdot \text{m}^2$	$\nabla(\mathbf{F} \cdot \mathbf{G}) = (\mathbf{F} \cdot \nabla)\mathbf{G} + (\mathbf{G} \cdot \nabla)\mathbf{F} + \mathbf{F} \times (\nabla \times \mathbf{G}) + \mathbf{G} \times (\nabla \times \mathbf{F})$
$\epsilon_0 = 8.85 \times 10^{-12} \text{ F/m}$	$\nabla \cdot (\phi\mathbf{F}) = \phi(\nabla \cdot \mathbf{F}) + \mathbf{F} \cdot \nabla\phi$
$\mu_0 = 1.26 \times 10^{-6} \text{ H/m}$	$\nabla \cdot (\mathbf{F} \times \mathbf{G}) = \mathbf{G} \cdot \nabla \times \mathbf{F} - \mathbf{F} \cdot \nabla \times \mathbf{G}$
$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$	$\nabla \cdot (\nabla \times \mathbf{F}) = 0$
$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$	$\nabla \times (\phi\mathbf{F}) = \phi(\nabla \times \mathbf{F}) + \nabla\phi \times \mathbf{F}$
$2 \cos A \cos B = \cos(A - B) + \cos(A + B)$	$\nabla \times (\mathbf{F} \times \mathbf{G}) = \mathbf{F}(\nabla \cdot \mathbf{G}) - \mathbf{G}(\nabla \cdot \mathbf{F}) + (\mathbf{G} \cdot \nabla)\mathbf{F} - (\mathbf{F} \cdot \nabla)\mathbf{G}$
$2 \sin A \sin B = \cos(A - B) - \cos(A + B)$	$\nabla \times (\nabla \times \mathbf{F}) = \nabla(\nabla \cdot \mathbf{F}) - \nabla^2\mathbf{F}$
$2 \sin A \cos B = \sin(A + B) + \sin(A - B)$	$\nabla \times \nabla\phi = 0$
$2 \cos A \sin B = \sin(A + B) - \sin(A - B)$	$\oint_S (\mathbf{F} \cdot \mathbf{n}) da = \int_V (\nabla \cdot \mathbf{F}) d^3x$
$\sin 2A = 2 \sin A \cos A$	$\oint_C \mathbf{F} \cdot d\mathbf{l} = \int_S (\nabla \times \mathbf{F}) \cdot \mathbf{n} da$
$\cos 2A = 2 \cos^2 A - 1$	$\int_S \phi \mathbf{n} da = \int_V \nabla\phi d^3x$
$\cos 2A = 1 - 2 \sin^2 A$	$\int_S \mathbf{F}(\mathbf{G} \cdot \mathbf{n}) da = \int_V [\mathbf{F}(\nabla \cdot \mathbf{G}) + (\mathbf{G} \cdot \nabla)\mathbf{F}] d^3x$
$\sin^2\left(\frac{A}{2}\right) = \frac{1}{2}(1 - \cos A)$	$\int_S (\mathbf{n} \times \mathbf{F}) da = \int_V (\nabla \times \mathbf{F}) d^3x$
$\cos^2\left(\frac{A}{2}\right) = \frac{1}{2}(1 + \cos A)$	
$\sinh x = \frac{1}{2}(e^x - e^{-x})$	
$\cosh x = \frac{1}{2}(e^x + e^{-x})$	