

Vector Formulas

$$(\mathbf{a} \times \mathbf{v})$$

If \mathbf{x}
 $r = |\mathbf{x}|$,
 then

- (a) $\mathbf{u} = \frac{\mathbf{x}}{r}$
- (b) $\mathbf{v} = \frac{\mathbf{y}}{r}$
- (c) $\mathbf{w} = \frac{\mathbf{z}}{r}$
- (d) $\mathbf{a} = \frac{\mathbf{p}}{r}$
- (e) $\mathbf{b} = \frac{\mathbf{q}}{r}$
- (f) $\mathbf{c} = \frac{\mathbf{r}}{r}$
- (g) $\mathbf{d} = \frac{\mathbf{s}}{r}$
- (h) $\mathbf{e} = \frac{\mathbf{t}}{r}$

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Explicit Forms of Vector Operations

$\frac{7}{2}$

where we have
 $x_3 = y$ and also

$$\begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{pmatrix} = \begin{pmatrix} \gamma(x_1' + \beta x_2') \\ \gamma(x_2' + \beta x_1') \\ x_3' \\ x_4' \end{pmatrix} \quad (11.17)$$

$$\begin{pmatrix} x_1' \\ x_2' \\ x_3' \\ x_4' \end{pmatrix} = \begin{pmatrix} \gamma(x_1 - \beta x_2) \\ \gamma(x_2 - \beta x_1) \\ x_3 \\ x_4 \end{pmatrix} \quad (11.18)$$

The inverse Lorentz

$$\begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{pmatrix} = \begin{pmatrix} \gamma(x_1' + \beta x_2') \\ \gamma(x_2' + \beta x_1') \\ x_3' \\ x_4' \end{pmatrix} \quad (11.19)$$

$$\begin{aligned} x_0' &= \gamma(x_0 - \beta x_1) \\ x_1' &= \gamma(x_1 - \beta x_0) \end{aligned} \quad (11.19)$$

where the parallel
 velocity $v = c\beta$.
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 the invariance,

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$$\mathbf{E} \quad \gamma \mathbf{E} \quad \mathbf{B} \quad \frac{\gamma}{\gamma} \quad \cdot \mathbf{E} \quad \$$$

$$\mathbf{B} \quad \gamma \mathbf{B} \quad \mathbf{E}/c \quad \frac{\gamma}{\gamma} \quad i \mathbf{B}$$

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$$: ">$- .86($>+&$ \frac{\gamma^2}{\gamma+1} = \frac{\gamma}{\beta^2} \frac{1}{\beta^2} \$, \$: ">$?#&, &#;$$$

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$$\begin{pmatrix} 0 & -E_x/c & -E_y/c & -E_z/c \\ E_x/c & 0 & -B_z & B_y \\ E_y/c & B_z & 0 & -B_x \\ E_z/c & -B_y & B_x & 0 \end{pmatrix}$$

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Thus the gradient drift \mathbf{v}_G

$$\mathbf{v}_G = \frac{1}{2} \frac{c}{B^2} \nabla B \times \mathbf{B}$$

An alternative form, including

$$\frac{1}{B} \nabla B \times \mathbf{B}$$

With the definition of $\omega_B = eE_0 / B$

$$v^2 = v_0^2 = v_{10}^2 \frac{B(z)}{B_0}$$