PHYS 87

Exercises (November 2, 2016):

1. Typeset

$$a^2 = b^2 + c^2$$

2. Typeset

$$F = G_N \frac{m_1 m_2}{r^2}$$

3. Typeset

$$n_\pm(E,T) = \frac{1}{e^{\frac{E}{k_B T}} \pm 1} = \frac{1}{e^{\hbar\omega/k_B T} \pm 1}$$

Note: This uses the greek letter `\omega` *and the symbol* `\hbar`*.*

4. Typeset

$$F_{\mu\nu} = [D_\mu, D_\nu] = \partial_\mu A_\nu - \partial_\nu A_\mu = \partial_{[\mu} A_{\nu]}$$

Note: This uses the greek letters `\mu` *and* `\nu`*, and the symbol* `\partial`*.*

5. Typeset this:

"Taylor expansion $e^x = \sum_{n=0}^\infty \frac{1}{n!} x^n$."

$$\int_0^1 \frac{df}{dx} dx = f(1) - f(0)$$

$$e^{\zeta(s)} = \prod_{n=1}^\infty e^{1/n^s}$$

(This uses the greek letter zeta).

Exercise 1:
```
\item Typeset
\[
a^2=b^2+c^2
\]
\bigskip
```

Exercise 2:
```
\[
F = G_N\frac{m_1m_2}{r^2}
\]
\bigskip
```

Exercise 3:
```
\[
n_{\pm}(E,T)=\frac1{e^{\frac{E}{k_BT}}\pm1}
           =\frac1{e^{{\hbar\omega}/{k_BT}}\pm1}
\]
\bigskip
```

Exercise 4:
```
\[
F_{\mu\nu}  =  [D_\mu  ,   D_\nu]
   =\partial_\mu A_\nu-\partial_\nu A_\mu
 =\partial_{[\mu} A_{\nu]}
\]
```

Exercise 5:
```
‘‘Taylor expansion $e^x=\sum_{n=0}^\infty \frac1{n!}x^n$.’’
\[\int_{0}^1 \frac{df}{dx}dx= f(1)-f(0)\]
\[e^{\zeta(s)}=\prod_{n=1}^\infty e^{1/n^s}\]
```

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Exercises (November 9, 2016):

1. Typeset this definition:

$$\int_0^\infty f(x)\,dx \equiv \lim_{t\to\infty}\int_0^t f(x)\,dx$$

2. Typeset this equation:

$$\sqrt[n]{x^{1/n}} = (\sqrt[n]{x})^{\frac{1}{n}} = x^{1/n^2}$$

3. Typeset:

$$|\vec{a}+\vec{b}|^2 = \vec{a}\cdot\vec{a} + 2\vec{a}\cdot\vec{b} + \vec{b}\cdot\vec{b}$$

4. Typeset these two expressions as separate *displayed equations*:

$$2\left[3\frac{a}{z}+2\left(\frac{a}{d}+7\right)\right] \qquad x^2\left(\sum_n A_n + 3\left(b+\frac{1}{c}\right)\right)\Bigg]_0$$

5. Typeset this, using the `multline*` environment:

$$2\left(1+\frac{1}{2}+\frac{1}{2^2}+\frac{1}{2^3}+\frac{1}{2^4}+\frac{1}{2^5}+\frac{1}{2^6}+\frac{1}{2^7}+\frac{1}{2^8}+\frac{1}{2^9}\right.$$
$$\left.+\frac{1}{2^{10}}+\frac{1}{2^{11}}\right) = \frac{4095}{1024}$$

6. We previously had

```
\[ 2\left[3\frac{a}{z}+
      2\left(\frac{a}{d}+7\right)\right] \]
```

giving

$$2\left[3\frac{a}{z}+2\left(\frac{a}{d}+7\right)\right]$$

Make it look like this:

$$2\Bigg[3\frac{a}{z}+2\Bigg(\frac{a}{d}+7\Bigg)\Bigg]$$

Solutions

Exercise 1: `\[ \int_0^\infty f(x)\,dx\equiv \lim_{t\to\infty}\int_0^t f(x)\,dx \]`

Exercise 2: `\[ \sqrt[n]{x^{{1/n}}}=(\sqrt[n]{x})^{\frac{1}{n}}=x^{1/n^2}\]`

Exercise 3: `\[ |\vec a +\vec b|^2=\vec a \cdot \vec a+2\vec a \cdot \vec b+\vec b \cdot \vec b \]`

Exercise 4:
```
\[2\left[3\frac{a}{z}+2\left(\frac{a}{d}+7\right)\right] \]
\[ \left.x^2\left(\sum_nA_n+3\left(b+\frac1c\right)\right)\right]_0\]
```

Exercise 5:
```
\begin{multline*}
2\left(1+\frac12+\frac1{2^2}+\frac1{2^3}+\frac1{2^4}
       +\frac1{2^5}+\frac1{2^6}+\frac1{2^7}
               +\frac1{2^8}+\frac1{2^9}\right.\\
\left.+\frac1{2^{10}}+\frac1{2^{11}}\right)=\frac{4095}{1024}
\end{multline*}
```

Exercise 6:
```
\[ 2\Bigg[3\frac{a}{z}+
       2\bigg(\frac{a}{d}+7\bigg)\Bigg] \]
```

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Exercises (November 16, 2016):

1. Typeset:

   The Pauli matrices are:

$$\sigma^1 = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}, \quad \sigma^2 = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix} \quad \text{and} \quad \sigma^3 = \begin{pmatrix} 1 & \\ 0 & -1 \end{pmatrix}$$

2. Exercise: Typeset

Shape	Area	Perimeter
Disk of radius R	πR^2	$2\pi R$
Rectangle of sides L_1 and L_2	$L_1 L_2$	$2(L_1 + L_2)$
Square of side $L_1 = L_2$		
Right triangle, base b and height h	$\frac{1}{2}bh$	$b + h + \sqrt{b^2 + h^2}$

3. Optional exercise: Typeset this (note the alignment at equal sign)

a	$x^2 + y = 30$
b	$100 = \sin(\theta) + \cos\varphi$
c	$q \cup p = q \cap p$

Solutions:

Exercise 1: The Pauli matrices are:

```
\[\sigma^1=\begin{pmatrix}0&1\\1&0\end{pmatrix},\quad
\sigma^2=\begin{pmatrix}0&-i\\i&0\end{pmatrix}\quad\text{and}\quad
\sigma^3=\begin{pmatrix}1&\\0&-1\end{pmatrix}
\]
```

Exercise 2: Solution:

```
\begin{center}
\begin{tabular}{|p{2in}|c|c|}
Shape&Area&Perimeter\\
\hline\hline
Disk of radius $R$ &$\pi R^2$ & $2\pi R$\\
\hline
Rectangle of sides $L_1$ and $L_2$ & $L_1L_2$&$2(L_1+L_2)$\\
\cline{1-1}
Square of side $L_1=L_2$ & & \\
\hline
Right triangle, base $b$ and height $h$ & $\frac12bh$&$b+h+\sqrt{b^2+h^2}$
\end{tabular}
\end{center}
```

Exercise 3: Solution:

```
\begin{center}
\begin{tabular}{|l|r@{~$=$~}l|}
\hline
a&$x^2+y$&30\\\hline
b&100&$\sin(\theta)+\cos\varphi$\\\hline
c&$q\cup p$&$q \cap p$\\\hline
\end{tabular}
\end{center}
```