Appendix for Hw3, III.2. Relevant integrals.

In[151]:= `ClearAll[m, px, q, wp, n, i, e]`

```
$Assumptions = m > 0 && q > 0 && a > 0;
wp = Sqrt[ a^2 + m^2 + px^2];
n = Integrate[ (1 / (2 wp)) ( 1 / (wp Sqrt[m^2 + q^2] - px q) - 1 / (wp m) )^2,
    {px, -Infinity, Infinity}] // FullSimplify;
n // TraditionalForm
e = Integrate[ (1 / (2)) ( 1 / (wp Sqrt[m^2 + q^2] - px q) - 1 / (wp m) )^2,
    {px, -Infinity, Infinity}] // FullSimplify;
e // TraditionalForm
```

Out[155]//TraditionalForm=

$$\frac{2\,q - 2\,m \tanh^{-1}\left(\dfrac{q}{\sqrt{m^2+q^2}}\right)}{a^2\,m^2\,q + m^4\,q}$$

Out[157]//TraditionalForm=

$$\frac{\pi\left(\sqrt{m^2 + q^2}\ - m\right)}{2\,m^3\,\sqrt{a^2 + m^2}}$$

In[159]:= `Integrate[ 1 / (x^2 + y^2), {x, -Infinity, Infinity}, {y, -Infinity, Infinity}]`
`Integrate[ 1 / Sqrt[x^2 + y^2], {x, -Infinity, Infinity}, {y, -Infinity, Infinity}]`

⬚ **Integrate**: Integral of $\dfrac{\pi}{\mathrm{Abs}[x]}$ does not converge on $\{-\infty, \infty\}$.

⬚ **Integrate**: Integral of $\dfrac{\pi}{\mathrm{Abs}[x]}$ does not converge on $\{-\infty, \infty\}$.

Out[159]= $\displaystyle\int_{-\infty}^{\infty} \frac{\pi}{\mathrm{Abs}[x]}\ dx$

⬚ **Integrate**: Integral of $\dfrac{1}{\sqrt{x^2 + y^2}}$ does not converge on $\{-\infty, \infty\}$.

Out[160]= $\displaystyle\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} \frac{1}{\sqrt{x^2 + y^2}}\ dy\ dx$

In[163]:= `Integrate[ 1 / (x^2 + y^2), {x, -a, a}, {y, -a, a}]`

`Integrate[ 1 / Sqrt[x^2 + y^2], {x, -a, a}, {y, -a, a}] // FullSimplify`

⬜ **Integrate**: Integral of $\dfrac{2\,\mathrm{ArcTan}\left[\frac{a}{x}\right]}{x}$ does not converge on {–a, a}.

⬜ **Integrate**: Integral of $\dfrac{2\,\mathrm{ArcTan}\left[\frac{a}{x}\right]}{x}$ does not converge on {–a, a}.

Out[163]= $\displaystyle\int_{-a}^{a} \dfrac{2\,\mathrm{ArcTan}\left[\frac{a}{x}\right]}{x}\,dx$

Out[164]= `8 a ArcSinh[1]`

In[165]:= `ArcSinh[1] // N`

Out[165]= `0.881374`