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(%i1) kill(all);
(%o0) done
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```
(%i1) assume(c>0);
(%o1) [c>0]
```

```
(%i2) depends([v_x, v_y], t);
(%o2) [v_x(t), v_y(t)]
```

```
(%i3) gamma: 1/sqrt(1-(v_x^2+v_y^2)/c^2);
(%o3) 
$$\frac{1}{\sqrt{1 - \frac{v_y^2 + v_x^2}{c^2}}}$$

```

□ **1 x component of p**

```
(%i4) diff(gamma*m*v_x, t);
(%o4) 
$$\frac{m v_x \left( 2 v_y \left( \frac{d}{d t} v_y \right) + 2 v_x \left( \frac{d}{d t} v_x \right) \right)}{2 c^2 \left( 1 - \frac{v_y^2 + v_x^2}{c^2} \right)^{3/2}} + \frac{m \left( \frac{d}{d t} v_x \right)}{\sqrt{1 - \frac{v_y^2 + v_x^2}{c^2}}}$$

```

```
(%i5) ratsubst(%gamma, gamma, %);
(%o5) 
$$\frac{\gamma^3 m v_x v_y \left( \frac{d}{d t} v_y \right) + \left( \gamma^3 m v_x^2 + \gamma c^2 m \right) \left( \frac{d}{d t} v_x \right)}{c^2}$$

```

□ **2 y component of p**

```
(%i6) diff(gamma*m*v_y, t);
(%o6) 
$$\frac{m v_y \left( 2 v_y \left( \frac{d}{d t} v_y \right) + 2 v_x \left( \frac{d}{d t} v_x \right) \right)}{2 c^2 \left( 1 - \frac{v_y^2 + v_x^2}{c^2} \right)^{3/2}} + \frac{m \left( \frac{d}{d t} v_y \right)}{\sqrt{1 - \frac{v_y^2 + v_x^2}{c^2}}}$$

```

```
(%i7) ratsubst(%gamma, gamma, %);
(%o7) 
$$\frac{\left( \gamma^3 m v_y^2 + \gamma c^2 m \right) \left( \frac{d}{d t} v_y \right) + \gamma^3 m v_x \left( \frac{d}{d t} v_x \right) v_y}{c^2}$$

```