```
> with(student);
```

$[D, \mathit{Diff}, \mathit{Doubleint}, \mathit{Int}, \mathit{Limit}, \mathit{Lineint}, \mathit{Product}, \mathit{Sum}, \mathit{Tripleint}, \mathit{changevar},$ $\qquad$ **(1)**

$\quad \mathit{completesquare}, \mathit{distance}, \mathit{equate}, \mathit{integrand}, \mathit{intercept}, \mathit{intparts}, \mathit{leftbox},$

$\quad \mathit{leftsum}, \mathit{makeproc}, \mathit{middlebox}, \mathit{middlesum}, \mathit{midpoint}, \mathit{powsubs}, \mathit{rightbox},$

$\quad \mathit{rightsum}, \mathit{showtangent}, \mathit{simpson}, \mathit{slope}, \mathit{summand}, \mathit{trapezoid}]$

```
> fx1 := k·(sqrt((x_1)^2 + (y_1)^2) - L)·(-x_1)/sqrt((x_1)^2 + (y_1)^2) + k·(sqrt((x_2 - x_1)^2 + (y_2 - y_1)^2) - L)·(x_2 - x_1)/sqrt((x_2 - x_1)^2 + (y_2 - y_1)^2);
```

$$fx1 := -\frac{k\left(\sqrt{x_1^2 + y_1^2} - L\right) x_1}{\sqrt{x_1^2 + y_1^2}} + \frac{k\left(\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} - L\right)(x_2 - x_1)}{\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}} \qquad \textbf{(2)}$$

```
> diff(fx1, x_1) : simplify(%);
```

$$\left(\left(\left(x_1^2 - 2\,x_2\,x_1 + x_2^2 + y_1^2 - 2\,y_2\,y_1 + y_2^2\right)\left(\left(-2\,x_1^2 - 2\,y_1^2\right)\sqrt{x_1^2 + y_1^2}\right. \right. \qquad \textbf{(3)}$$

$$\left. + L\,y_1^2\right)\sqrt{x_1^2 - 2\,x_2\,x_1 + x_2^2 + (-y_2 + y_1)^2} + L\left(x_1^2 + y_1^2\right)^{3/2}\left(-y_2 + y_1\right)^2\right)$$

$$\left. k\right)\Big/\left(\left(x_1^2 + y_1^2\right)^{3/2}\left(x_1^2 - 2\,x_2\,x_1 + x_2^2 + (-y_2 + y_1)^2\right)^{3/2}\right)$$

```
> diff(fx1, y_1) : simplify(%);
```

$$-\left(\left(x_1\,y_1\left(x_1^2 - 2\,x_2\,x_1 + x_2^2 + y_1^2 - 2\,y_2\,y_1\right. \right. \right. \qquad \textbf{(4)}$$

$$\left. + y_2^2\right)\sqrt{x_1^2 - 2\,x_2\,x_1 + x_2^2 + (-y_2 + y_1)^2} + \left(x_1^2 + y_1^2\right)^{3/2}\left(-y_2 + y_1\right)\left(-x_2\right.$$

$$\left.\left.\left. + x_1\right)\right)\,k\,L\right)\Big/\left(\left(x_1^2 + y_1^2\right)^{3/2}\left(x_1^2 - 2\,x_2\,x_1 + x_2^2 + (-y_2 + y_1)^2\right)^{3/2}\right)$$

```
> diff(fx1, x_2) : simplify(%);
```

$$-\frac{1}{\left(x_1^2 - 2\,x_2\,x_1 + x_2^2 + (-y_2 + y_1)^2\right)^{3/2}}\left(\left(\left(-y_1^2 + 2\,y_2\,y_1 - y_2^2 - \left(-x_2\right.\right.\right.\right. \qquad \textbf{(5)}$$

$$\left.\left.\left. + x_1\right)^2\right)\sqrt{x_1^2 - 2\,x_2\,x_1 + x_2^2 + (-y_2 + y_1)^2} + L\left(-y_2 + y_1\right)^2\right)\,k\right)$$

```
> diff(fx1, y_2) : simplify(%);
```

$$\frac{k\left(-x_2 + x_1\right)\left(-y_2 + y_1\right)L}{\left(x_1^2 - 2\,x_2\,x_1 + x_2^2 + (-y_2 + y_1)^2\right)^{3/2}} \qquad \textbf{(6)}$$

```
> fy1 := k·(sqrt((x_1)^2 + (y_1)^2) - L)·(-y_1)/sqrt((x_1)^2 + (y_1)^2) + k·(sqrt((x_2 - x_1)^2 + (y_2 - y_1)^2) - L)·(y_2 - y_1)/sqrt((x_2 - x_1)^2 + (y_2 - y_1)^2) - m·g;
```

(7)

$$fy1 := -\frac{k\left(\sqrt{x_1^2 + y_1^2} - L\right) y_1}{\sqrt{x_1^2 + y_1^2}} + \frac{k\left(\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} - L\right)(y_2 - y_1)}{\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}}$$

$$- m\,g \qquad (7)$$

> `diff(fy1, x₁) : simplify(%);`

$$-\Bigg(\Big(x_1\,y_1\,\big(x_1^2 - 2\,x_2\,x_1 + x_2^2 + y_1^2 - 2\,y_2\,y_1$$

$$+ y_2^2\big)\sqrt{x_1^2 - 2\,x_2\,x_1 + x_2^2 + (-y_2 + y_1)^2} + \left(x_1^2 + y_1^2\right)^{3/2}(-y_2 + y_1)\,(-x_2$$

$$+ x_1)\Big)\,k\,L\Bigg) \Big/ \left(\left(x_1^2 + y_1^2\right)^{3/2}\left(x_1^2 - 2\,x_2\,x_1 + x_2^2 + (-y_2 + y_1)^2\right)^{3/2}\right) \qquad (8)$$

> `diff(fy1, y₁) : simplify(%);`

$$\Bigg(\Big(\big(x_1^2 - 2\,x_2\,x_1 + x_2^2 + y_1^2 - 2\,y_2\,y_1 + y_2^2\big)\left(\left(-2\,x_1^2 - 2\,y_1^2\right)\sqrt{x_1^2 + y_1^2}\right.$$

$$\left. + L\,x_1^2\right)\sqrt{x_1^2 - 2\,x_2\,x_1 + x_2^2 + (-y_2 + y_1)^2} + L\left(x_1^2 + y_1^2\right)^{3/2}(-x_2 + x_1)^2\Big)$$

$$k\Bigg) \Big/ \left(\left(x_1^2 + y_1^2\right)^{3/2}\left(x_1^2 - 2\,x_2\,x_1 + x_2^2 + (-y_2 + y_1)^2\right)^{3/2}\right) \qquad (9)$$

> `diff(fy1, x₂) : simplify(%);`

$$\frac{k\,(-x_2 + x_1)\,(-y_2 + y_1)\,L}{\left(x_1^2 - 2\,x_2\,x_1 + x_2^2 + (-y_2 + y_1)^2\right)^{3/2}} \qquad (10)$$

> `diff(fy1, y₂) : simplify(%);`

$$-\frac{1}{\left(x_1^2 - 2\,x_2\,x_1 + x_2^2 + (-y_2 + y_1)^2\right)^{3/2}}\Bigg(\Big(\big(-x_1^2 + 2\,x_2\,x_1 - x_2^2 - (-y_2$$

$$+ y_1)^2\big)\sqrt{x_1^2 - 2\,x_2\,x_1 + x_2^2 + (-y_2 + y_1)^2} + L\,(-x_2 + x_1)^2\Big)\,k\Bigg) \qquad (11)$$

> `fx2 := k·(sqrt((x₂ − x₁)² + (y₂ − y₁)²) − L)·` $\dfrac{x_1 - x_2}{\mathrm{sqrt}\left((x_2 - x_1)^2 + (y_2 - y_1)^2\right)}$ `;`

$$fx2 := \frac{k\left(\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} - L\right)(-x_2 + x_1)}{\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}} \qquad (12)$$

> `diff(fx2, x₁) : simplify(%);`

$$-\frac{1}{\left(x_1^2 - 2\,x_2\,x_1 + x_2^2 + (-y_2 + y_1)^2\right)^{3/2}}\Bigg(\Big(\big(-y_1^2 + 2\,y_2\,y_1 - y_2^2 - (-x_2$$

$$+ x_1)^2\big)\sqrt{x_1^2 - 2\,x_2\,x_1 + x_2^2 + (-y_2 + y_1)^2} + L\,(-y_2 + y_1)^2\Big)\,k\Bigg) \qquad (13)$$

> `diff(fx2, y₁) : simplify(%);`

$$\frac{k\,(-x_2 + x_1)\,(-y_2 + y_1)\,L}{\left(x_1^2 - 2\,x_2\,x_1 + x_2^2 + (-y_2 + y_1)^2\right)^{3/2}} \qquad (14)$$

> `diff(fx2, x₂) : simplify(%);`

$$\frac{1}{\left(x_1^2 - 2\,x_2\,x_1 + x_2^2 + \left(-y_2 + y_1\right)^2\right)^{3/2}}\left(\left(\left(-y_1^2 + 2\,y_2\,y_1 - y_2^2 - \left(-x_2 \right.\right.\right.\right. \tag{15}$$
$$\left.\left.\left.\left. + x_1\right)^2\right)\,\sqrt{x_1^2 - 2\,x_2\,x_1 + x_2^2 + \left(-y_2 + y_1\right)^2} + L\,\left(-y_2 + y_1\right)^2\right)\,k\right)$$

> $diff(fx2,\ y_2)\ :\ simplify(\%);$

$$-\frac{k\,\left(-x_2 + x_1\right)\,\left(-y_2 + y_1\right)\,L}{\left(x_1^2 - 2\,x_2\,x_1 + x_2^2 + \left(-y_2 + y_1\right)^2\right)^{3/2}} \tag{16}$$

> $fy2 := k\cdot\left(\mathrm{sqrt}\left(\left(x_2 - x_1\right)^2 + \left(y_2 - y_1\right)^2\right) - L\right)\cdot\dfrac{y_1 - y_2}{\mathrm{sqrt}\left(\left(x_2 - x_1\right)^2 + \left(y_2 - y_1\right)^2\right)} - m\cdot g;$

$$fy2 := \frac{k\,\left(\sqrt{\left(x_2 - x_1\right)^2 + \left(y_2 - y_1\right)^2} - L\right)\,\left(-y_2 + y_1\right)}{\sqrt{\left(x_2 - x_1\right)^2 + \left(y_2 - y_1\right)^2}} - m\,g \tag{17}$$

> $diff(fy2,\ x_1)\ :\ simplify(\%);$

$$\frac{k\,\left(-x_2 + x_1\right)\,\left(-y_2 + y_1\right)\,L}{\left(x_1^2 - 2\,x_2\,x_1 + x_2^2 + \left(-y_2 + y_1\right)^2\right)^{3/2}} \tag{18}$$

> $diff(fy2,\ y_1)\ :\ simplify(\%);$

$$-\frac{1}{\left(x_1^2 - 2\,x_2\,x_1 + x_2^2 + \left(-y_2 + y_1\right)^2\right)^{3/2}}\left(\left(\left(-x_1^2 + 2\,x_2\,x_1 - x_2^2 - \left(-y_2 \right.\right.\right.\right. \tag{19}$$
$$\left.\left.\left.\left. + y_1\right)^2\right)\,\sqrt{x_1^2 - 2\,x_2\,x_1 + x_2^2 + \left(-y_2 + y_1\right)^2} + L\,\left(-x_2 + x_1\right)^2\right)\,k\right)$$

> $diff(fy2,\ x_2)\ :\ simplify(\%);$

$$-\frac{k\,\left(-x_2 + x_1\right)\,\left(-y_2 + y_1\right)\,L}{\left(x_1^2 - 2\,x_2\,x_1 + x_2^2 + \left(-y_2 + y_1\right)^2\right)^{3/2}} \tag{20}$$

> $diff(fy2,\ y_2)\ :\ simplify(\%);$

$$\frac{1}{\left(x_1^2 - 2\,x_2\,x_1 + x_2^2 + \left(-y_2 + y_1\right)^2\right)^{3/2}}\left(\left(\left(-x_1^2 + 2\,x_2\,x_1 - x_2^2 - \left(-y_2 \right.\right.\right.\right. \tag{21}$$
$$\left.\left.\left.\left. + y_1\right)^2\right)\,\sqrt{x_1^2 - 2\,x_2\,x_1 + x_2^2 + \left(-y_2 + y_1\right)^2} + L\,\left(-x_2 + x_1\right)^2\right)\,k\right)$$

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