If you want to remove all of the output, click Edit, remove output, from worksheet.

restart; $U := x^{3} \cdot y^{7}$;

$$x^{0.3}\, y^{0.7} \tag{1}$$

$constr := px \cdot x + py \cdot y = B$;

$$px\, x + py\, y = B \tag{2}$$

$Umax := U + \text{lambda} \cdot (B - px \cdot x - py \cdot y)$;

$$x^{0.3}\, y^{0.7} + \lambda\, (B - px\, x - py\, y) \tag{3}$$

$one := diff\,(Umax, x) = 0$;

$$\frac{0.3\, y^{0.7}}{x^{0.7}} - \lambda\, px = 0 \tag{4}$$

$two := diff\,(Umax, y) = 0$;

$$\frac{0.7\, x^{0.3}}{y^{0.3}} - \lambda\, py = 0 \tag{5}$$

$three := diff\,(Umax, \text{lambda}) = 0$;

$$B - px\, x - py\, y = 0 \tag{6}$$

$solve(\{one, two, three\}, \{x, y, \text{lambda}\})$; $assign(\%)$;

$$\left\{ \lambda = \frac{0.5428814527 \left(\frac{B}{px} \right)^{3/10}}{py \left(\frac{B}{py} \right)^{3/10}},\ x = \frac{0.3000000000\, B}{px},\ y = \frac{0.7000000000\, B}{py} \right\} \tag{7}$$

U;

$$0.5428814527 \left(\frac{B}{px} \right)^{0.3} \left(\frac{B}{py} \right)^{0.7} \tag{8}$$

Indirect Utility function: f(px, py, B) ==> Utility Homogenous of degree zero in p and B

Given indirect utility fn, find Marshalian demand for x.
Roy's Identity: demand for x x(px,py,B)= - [d(indirect)/dpx]/[d(indirect)/dB]

> $four := diff\,(U, px)$;

$$four := -\frac{0.1628644358 \left(\frac{B}{py} \right)^{0.7} B}{\left(\frac{B}{px} \right)^{0.7} px^{2}} \tag{9}$$

> $five := diff\,(U, B)$;

$$five := \frac{0.1628644358 \left(\frac{B}{py} \right)^{0.7}}{\left(\frac{B}{px} \right)^{0.7} px} + \frac{0.3800170169 \left(\frac{B}{px} \right)^{0.3}}{\left(\frac{B}{py} \right)^{0.3} py} \tag{10}$$

> $demandx := -1 \cdot \left(\frac{four}{five} \right)$;

$$demandx := \frac{0.1628644358 \left(\frac{B}{py}\right)^{0.7} B}{\left(\frac{B}{px}\right)^{0.7} px^2 \left(\frac{0.1628644358 \left(\frac{B}{py}\right)^{0.7}}{\left(\frac{B}{px}\right)^{0.7} px} + \frac{0.3800170169 \left(\frac{B}{px}\right)^{0.3}}{\left(\frac{B}{py}\right)^{0.3} py}\right)} \quad (11)$$

> simplify(**(11)**, 'symbolic')

$$\frac{0.3000000000\, B}{px} \quad (12)$$

> restart;

Hicksian : Minimize expenditure subject $U = Uo$. $x = f(Uo, px, py)$

> $Bud := px \cdot x + py \cdot y;$

$$Bud := px\, x + py\, y \quad (13)$$

> $minB := Bud + \text{lambda} \cdot \left(U - x^{.3} \cdot y^{.7}\right);$

$$minB := px\, x + py\, y + \lambda \left(U - x^{0.3}\, y^{0.7}\right) \quad (14)$$

> $one := diff(minB, x) = 0;$

$$one := px - \frac{0.3\, \lambda\, y^{0.7}}{x^{0.7}} = 0 \quad (15)$$

> $two := diff(minB, y) = 0;$

$$two := py - \frac{0.7\, \lambda\, x^{0.3}}{y^{0.3}} = 0 \quad (16)$$

> $three := diff(minB, \text{lambda}) = 0;$

$$three := U - x^{0.3}\, y^{0.7} = 0 \quad (17)$$

> $solve(\{one, two, three\}, \{x, y, \text{lambda}\});$

$$\left\{\lambda = \frac{18.14814815\, U^9\, px^3}{py^2\, RootOf\left(-343\, U^{10}\, px^3 + 27\, \_Z^{100}\, py^3\right)^{90}}, x\right. \quad (18)$$

$$= \frac{0.4285714286\, RootOf\left(-343\, U^{10}\, px^3 + 27\, \_Z^{100}\, py^3\right)^{10} py}{px}, y = RootOf\left(-343\, U^{10}\, px^3 + 27\, \_Z^{100}\, py^3\right)^{10}\Bigg\}$$

> convert(**(18)**, 'radical')

$$\left\{\lambda = \frac{0.05291005292\, 343^{1/10}\, 27^{9/10}\, U^9\, px^3}{py^2 \left(\frac{U^{10}\, px^3}{py^3}\right)^{9/10}}, x\right. \quad (19)$$

$$= \frac{0.01587301587\, 343^{1/10}\, 27^{9/10} \left(\frac{U^{10}\, px^3}{py^3}\right)^{1/10} py}{px}, y\Bigg\}$$

$$= \frac{1}{27}\ 343^{1/10}\ 27^{9/10} \left(\frac{U^{10}\ px^3}{py^3} \right)^{1/10} \Bigg\}$$

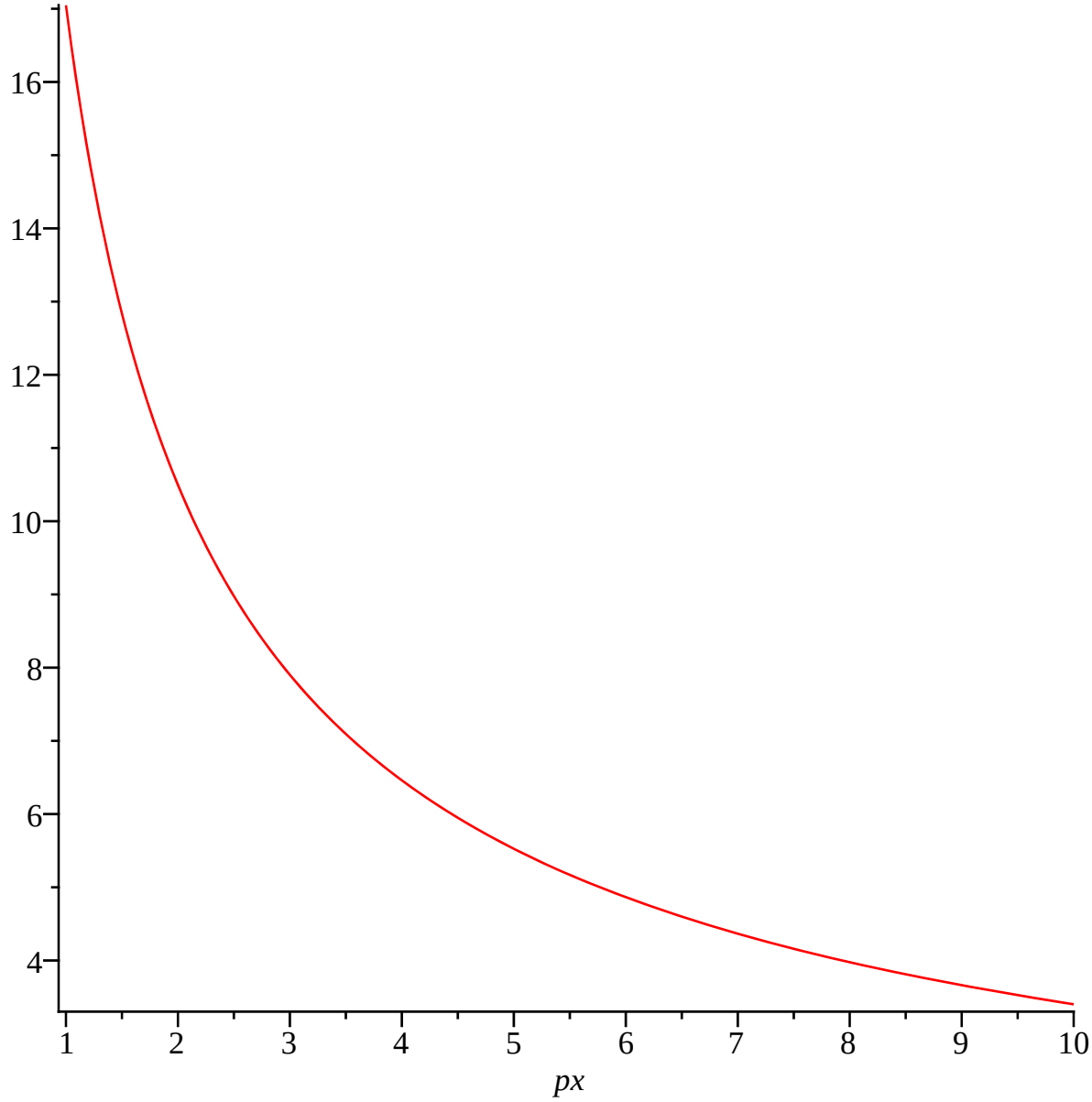
```
> map( simplify, (19), 'symbolic' ); assign(%);
```

$$\left\{ \lambda = 1.842022776\ py^{7/10}\ px^{3/10},\ x = \frac{0.5526068325\ U\ py^{7/10}}{px^{7/10}},\ y = \frac{1}{3}\ \frac{7^{3/10}\ 3^{7/10}\ U\ px^{3/10}}{py^{3/10}} \right\} \quad (20)$$

```
> U := 10; py := 5; plot( 0.5526068325 U py^(7/10) / px^(7/10), px = 1..10 );
```

$$U := 10$$

$$py := 5$$




```
> minB;
```

(21)

$$5.526068325\,5^{7/10}\,px^{3/10}+\frac{10}{3}\,7^{3/10}\,3^{7/10}\,5^{7/10}\,px^{3/10}+1.842022776\,5^{7/10}\,px^{3/10}\left(10-1.257363919\left(\frac{5^{7/10}}{px^{7/10}}\right)^{0.3}\left(7^{3/10}\,3^{7/10}\,5^{7/10}\,px^{3/10}\right)^{0.7}\right) \quad \textbf{(21)}$$

```
> simplify( (21), 'symbolic' )
```

$$56.82952141\,px^{3/10} \quad \textbf{(22)}$$

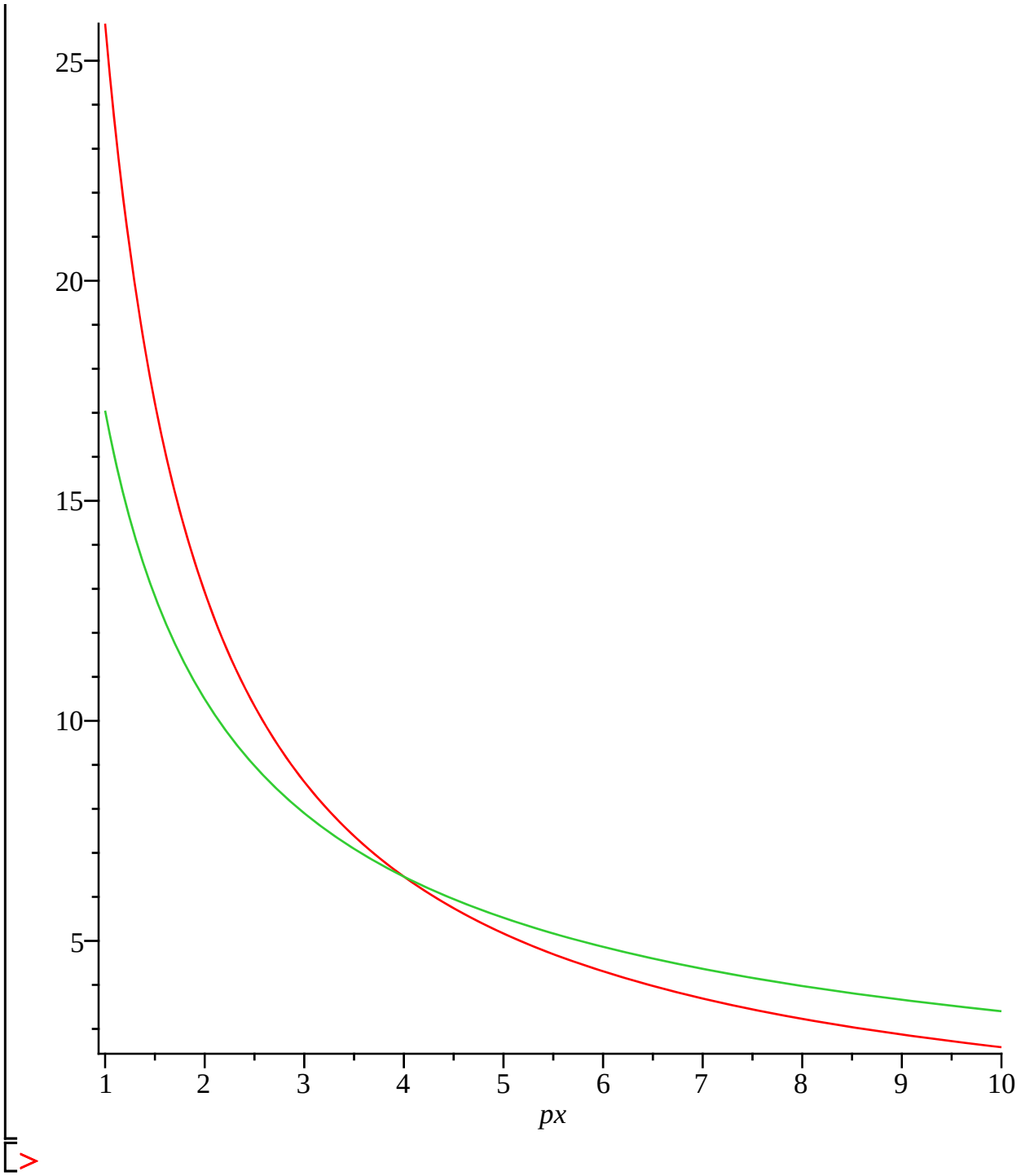
```
> subs( px = 4, % );
```

$$56.82952141\,4^{3/10} \quad \textbf{(23)}$$

```
> evalf (%);
```

$$86.13744710 \quad \textbf{(24)}$$

```
> plot( { 0.5526068325 U py^(7/10) / px^(7/10), 0.3000000000 ·86.14 / px }, px = 1 ..10 );
```


25
20
15
10
5
1
2
3
4
5
6
7
8
9
10
px