

# Matt Charnley - Section 22-24, January 22, 2015

## Maple Lab 0 - Answer Key

### Arithmetic

$$2^{300} \cdot 300^2$$

183333237870103747764160111956844034494632155429934262557252640441894316978700\  
303556505763840000 (1)

$$\frac{4}{7}$$
$$\frac{4}{7} \quad (2)$$

$$\% \cdot 700$$
$$400 \quad (3)$$

$$\text{expand}((\text{sqrt}(2) - 1)^5)$$
$$29\sqrt{2} - 41 \quad (4)$$

$$\text{evalf}(\%)$$
$$0.01219330 \quad (5)$$

$$\text{evalf}(\exp(\pi \cdot \text{sqrt}(163)), 30)$$
$$2.62537412640768744000000000024 \cdot 10^{17} \quad (6)$$

### Algebra

$$p := x^4 - 3x^2 + 1$$
$$x^4 - 3x^2 + 1$$

$$\text{factor}(p)$$
$$(x^2 + x - 1)(x^2 - x - 1) \quad (8)$$

$$\text{factor}(p, \text{real})$$
$$(x + 1.61803398874989)(x + 0.618033988749895)(x - 0.618033988749895)(x - 1.61803398874989) \quad (9)$$

$$\text{stuff} := x^3y + x \cdot y^2$$
$$x^3y + xy^2 \quad (10)$$

$$\text{subs}(\{x = 1\}, \text{stuff})$$
$$y^2 + y \quad (11)$$

$$\text{subs}(\{x = 1, y = x\}, \text{stuff})$$
$$x^2 + x \quad (12)$$

$$\text{subs}(\{x=y^2, y=x^3\}, \text{stuff}) \quad x^3 y^6 + x^6 y^2 \quad (13)$$

$$f := \left(x + \frac{1}{x}\right)^3 \quad \left(x + \frac{1}{x}\right)^3 \quad (14)$$

$$\text{subs}\left(x=2^{\left(\frac{1}{3}\right)}, f\right) \quad \left(2^{1/3} + \frac{1}{2} 2^{2/3}\right)^3 \quad (15)$$

$$\text{evalf}(\%) \quad 8.660864729 \quad (16)$$

$$fx := x \rightarrow \left(x + \frac{1}{x}\right)^3 \quad x \rightarrow \left(x + \frac{1}{x}\right)^3 \quad (17)$$

$$fx\left(2^{\frac{1}{3}}\right) \quad \left(2^{1/3} + \frac{1}{2} 2^{2/3}\right)^3 \quad (18)$$

$$\text{evalf}(\%) \quad 8.660864729 \quad (19)$$

$$pr := (r^2 + 3r + 4)^{10} \quad (r^2 + 3r + 4)^{10} \quad (20)$$

$$\begin{aligned} \text{expand}(pr) \\ r^{20} + 30 r^{19} + 445 r^{18} + 4320 r^{17} + 30690 r^{16} + 169236 r^{15} + 750450 r^{14} + 2737080 r^{13} \\ + 8332365 r^{12} + 21369150 r^{11} + 46406097 r^{10} + 85476600 r^9 + 133317840 r^8 \\ + 175173120 r^7 + 192115200 r^6 + 173297664 r^5 + 125706240 r^4 + 70778880 r^3 \\ + 29163520 r^2 + 7864320 r + 1048576 \end{aligned} \quad (21)$$

So the coefficient of  $r^7$  is 175173120.

$$\begin{aligned} \text{expand}\left(\frac{pr}{r^7}\right) \\ r^{13} + 30 r^{12} + 445 r^{11} + 4320 r^{10} + 30690 r^9 + 169236 r^8 + 750450 r^7 + 2737080 r^6 \\ + 8332365 r^5 + 21369150 r^4 + 46406097 r^3 + 85476600 r^2 + 133317840 r + 175173120 \\ + \frac{192115200}{r} + \frac{173297664}{r^2} + \frac{125706240}{r^3} + \frac{70778880}{r^4} + \frac{29163520}{r^5} + \frac{7864320}{r^6} \\ + \frac{1048576}{r^7} \end{aligned} \quad (22)$$

We get the same coefficient here. Possibly slightly easier to find in this case because it is the one right before where fractions start happening.

## Calculus

$$\text{diff}(x^3 \ln(x), x, x) \qquad 6x \ln(x) + 5x \qquad (23)$$

$$\text{diff}(x^3 \ln(x)^2, x, x) \qquad 6x \ln(x)^2 + 10x \ln(x) + 2x \qquad (24)$$

$$\text{int}\left(\frac{x^2}{x^2 + 1}, x\right) \qquad x - \arctan(x) \qquad (25)$$

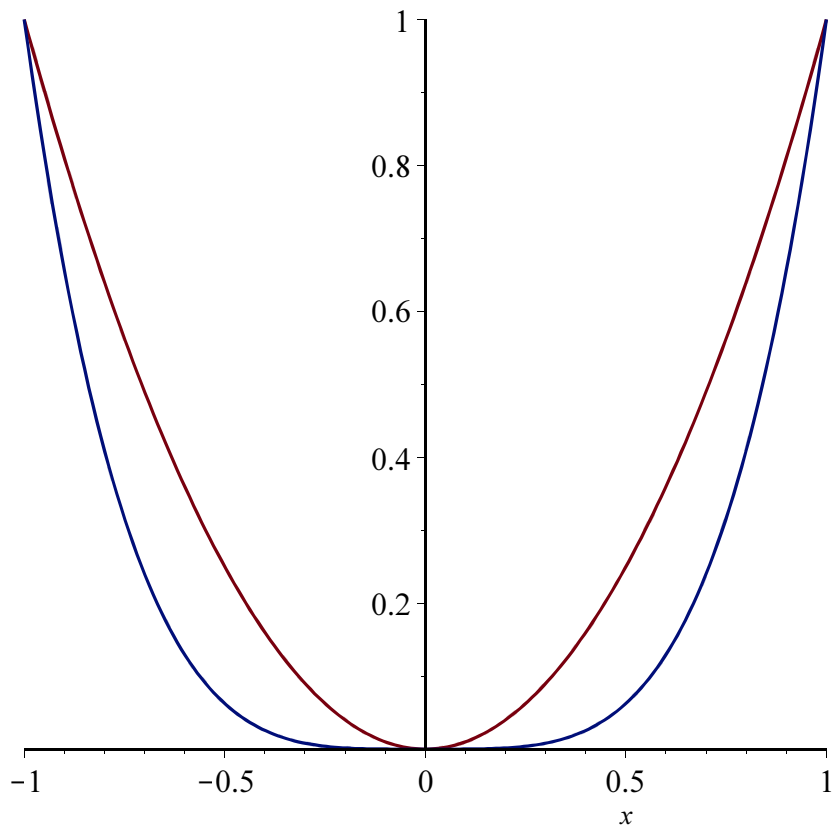
$$\text{int}(\exp(-x^2), x=0.. \infty) \qquad \frac{1}{2} \sqrt{\pi} \qquad (26)$$

$$\frac{\text{subs}(\{r=0\}, \text{diff}(pr, r\$7))}{7!} \qquad 175173120 \qquad (27)$$

## Graphing

*with(plots) :*

$$\text{plot}([x^2, x^4], x=-1..1)$$



$$f := x^3 - 5x \cdot y^2$$

$$x^3 - 5x y^2$$

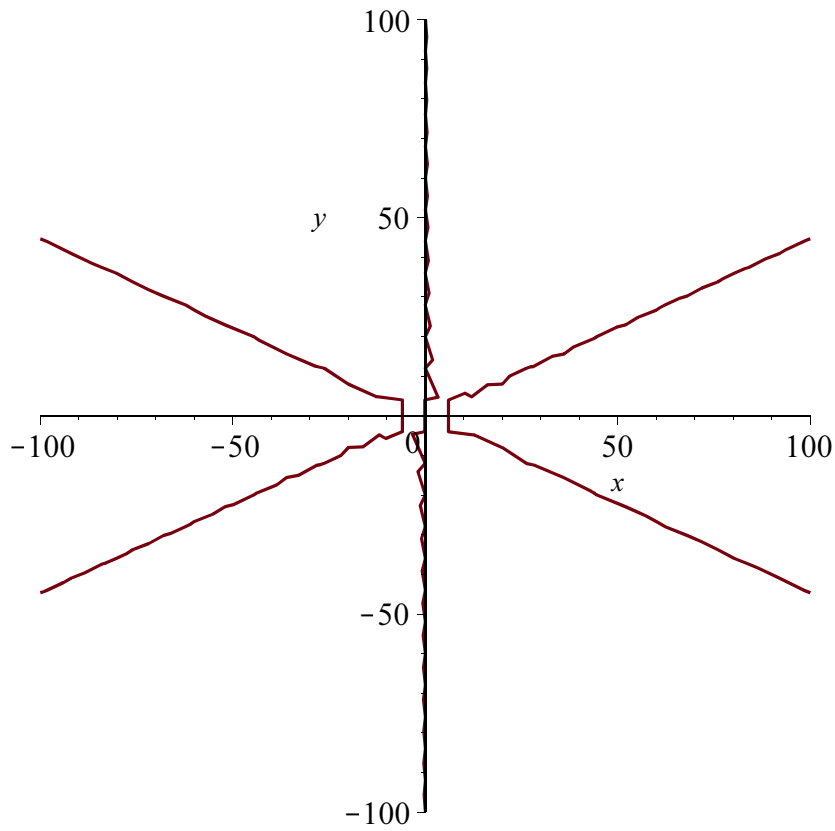
(28)

$$graph := A \rightarrow \text{implicitplot}(f=7, x=-A..A, y=-A..A)$$

$$A \rightarrow \text{plots:implicitplot}(f=7, x=-A..A, y=-A..A)$$

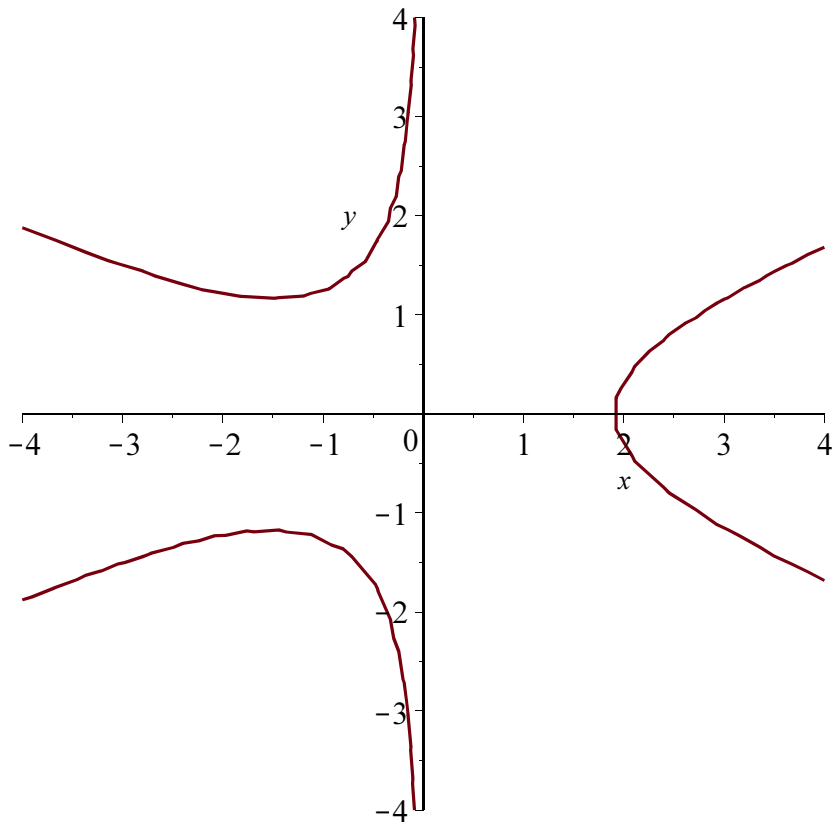
(29)

$$graph(100)$$



This plot is not reasonable. As we can see comparing it to the graph below, the graph changes at around a value of 40, where the two components in the negative  $x$ -region become a single curve, and the graph has a line along the  $y$ -axis.

*graph*(4)



This graph shows the distinct components of the graph and has a reasonable representation of the structure. Anything below about 10 looks fine for this graph.