> #1

> $expr := \dfrac{x^4 - x^3 - 11x^2 + 9x + 18}{x^4 - 3x^3 - 7x^2 + 27x - 18} : \dfrac{x^3 - 9x^2 + 26x - 24}{x^3 - 8x^2 + 19x - 12}$

$$\frac{x^3 - 9x^2 + 26x - 24}{x^3 - 8x^2 + 19x - 12} \quad (1)$$

> $simplify(expr)$

$$\frac{x+1}{x-1} \quad (2)$$

> #2

> $expr := (2x-1)\cdot(3x^2+5)\cdot(5x+2)$:

> $collect(expr, x)$

$$30x^4 - 3x^3 + 44x^2 - 5x - 10 \quad (3)$$

> #3

> $expr := 14x^4 - 46x^3 - 82x^2 + 138x + 120$:

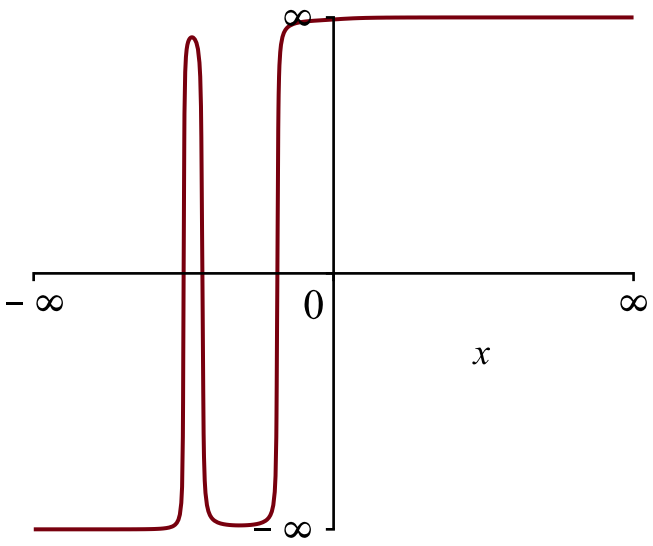
> $factor(expr)$

$$2(7x+5)(x-4)(x^2-3) \quad (4)$$

> #4

> $f := 12x^5 + 108x^4 + 315x^3 + 360x^2 + 303x + 252$:

> $plot(f(x), x = -\text{infinity}..\text{infinity})$



> $fsolve(f)$

$$-4.,\ -3.500000000,\ -1.500000000 \quad (5)$$

> #5

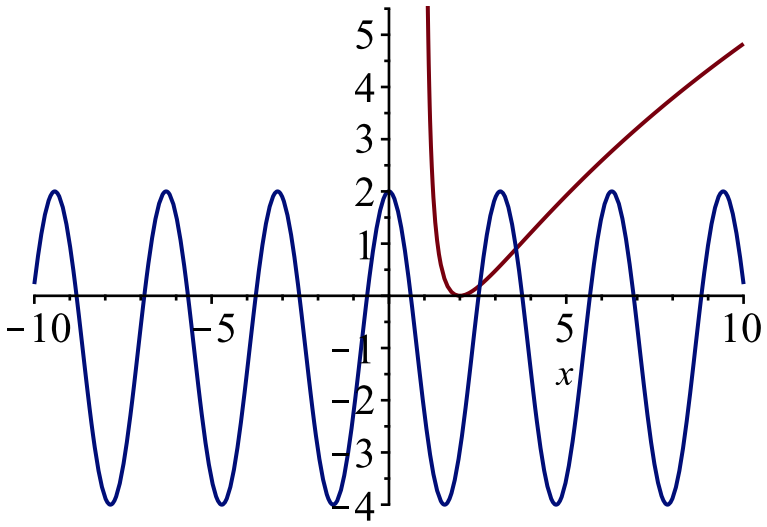
> $expr := \dfrac{5x^4 + 7x^3 + 5x - 4}{(x^2+4)\cdot(x-2)^2\cdot(x^2-1)}$:

> $convert(expr, parfrac)$

$$\frac{13}{10(x-1)} + \frac{-19x-23}{20(x^2+4)} + \frac{11}{90(x+1)} - \frac{17}{36(x-2)} + \frac{71}{12(x-2)^2} \quad (6)$$

> #6

```
> f1 := ln^2(x - 1) :
> f2 := 3 cos(2 x) - 1 :
> f := f1 = f2 :
> plot([f1, f2], x = -10 .. 10);
```



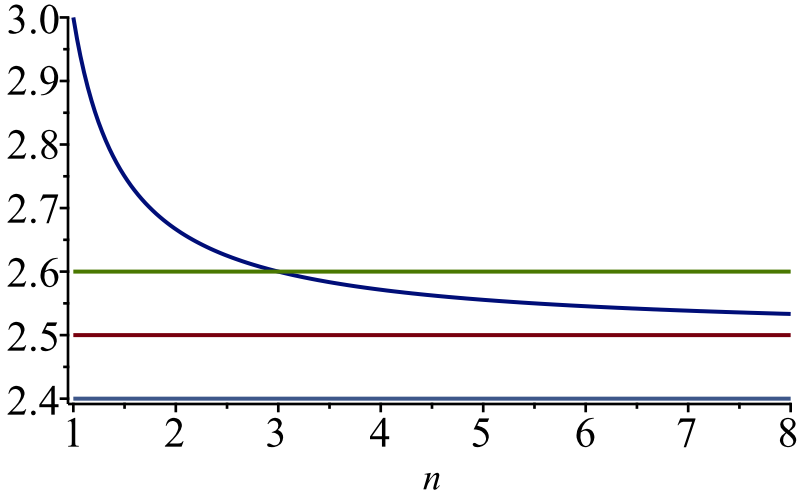

```
> fsolve(f, x = -infinity .. infinity)
```

2.561721559 **(7)**

```
> #7
> expr := (5 n - 2)/(2 n - 1) :
> solve({|5/2 - expr| < 0.1, n >= 1}, n)
```

{3. < n} **(8)**

```
> plot([5/2, expr, 5/2 + 0.1, 5/2 - 0.1], n = 1 .. 8)
```




```
> #8.1
> expr := n·(sqrt(n^2 + 1) - sqrt(n^2 - 1)) :
> limit(expr, n = infinity)
```

1 **(9)**

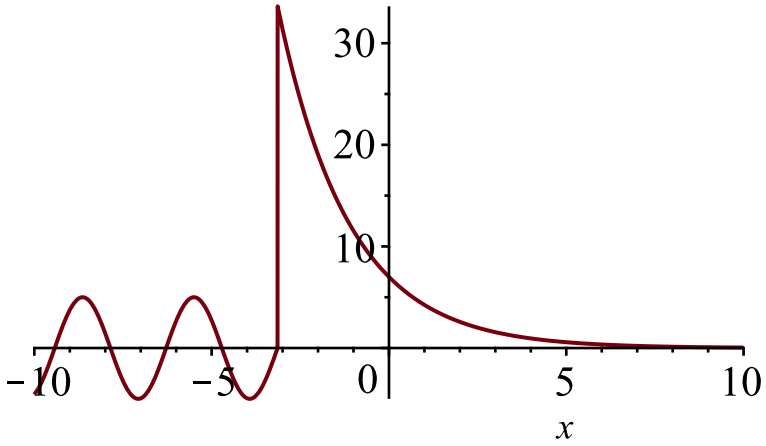
```
> #8.2
> expr := ( (3 n^2 - 6 n + 7) / (3 n^2 + 20 n - 1) )^(1 - n) :
> limit(expr, n = infinity)
```

$$e^{\frac{26}{3}} \tag{10}$$

```
> #9.1
> f := piecewise(x < -Pi, 5·sin(2 x), x >= -Pi, 7·e^(-0.5 x))
```

$$f := \begin{cases} 5\sin(2x) & x < -\pi \\ 7\,e^{-0.5x} & -\pi \le x \end{cases} \tag{11}$$

```
> plot(f, x = -10..10)
```




```
> #9.2
> limit(f, x = -Pi, left)
```

$$0. \tag{12}$$

```
> limit(f, x = -Pi, right)
```

$$33.67334167 \tag{13}$$

```
> limit(f, x = infinity, left)
```

$$0. \tag{14}$$

```
> limit(f, x = -infinity, right)
```

$$-5..5. \tag{15}$$

```
> #9.3
> fdiff := diff(f, x)
```

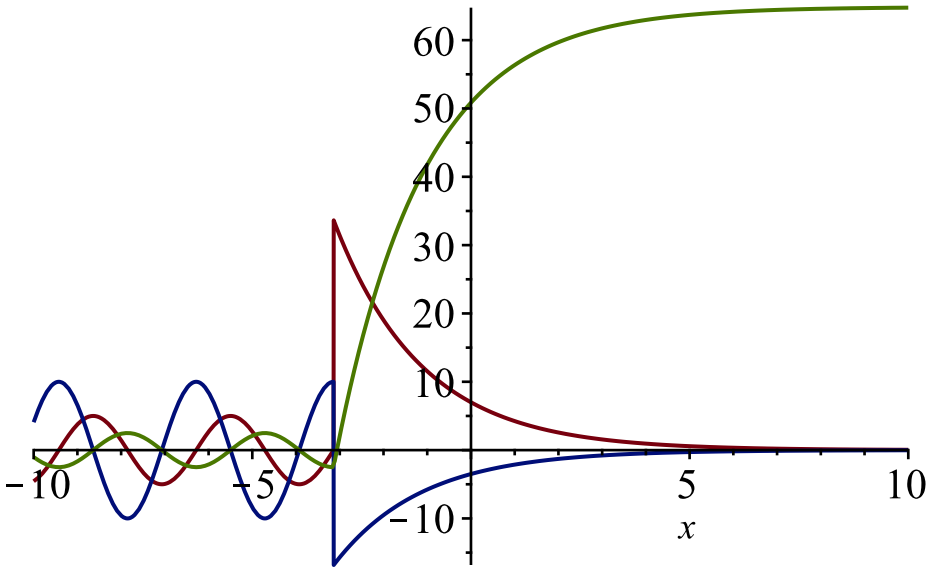
$$fdiff := \begin{cases} 10.\cos(2.x) & x < -3.141592654 \\ \text{Float(undefined)} & x = -3.141592654 \\ -3.500000000\,e^{-0.5000000000x} & -3.141592654 < x \end{cases} \tag{16}$$

```
> fint := int(f, x)
```

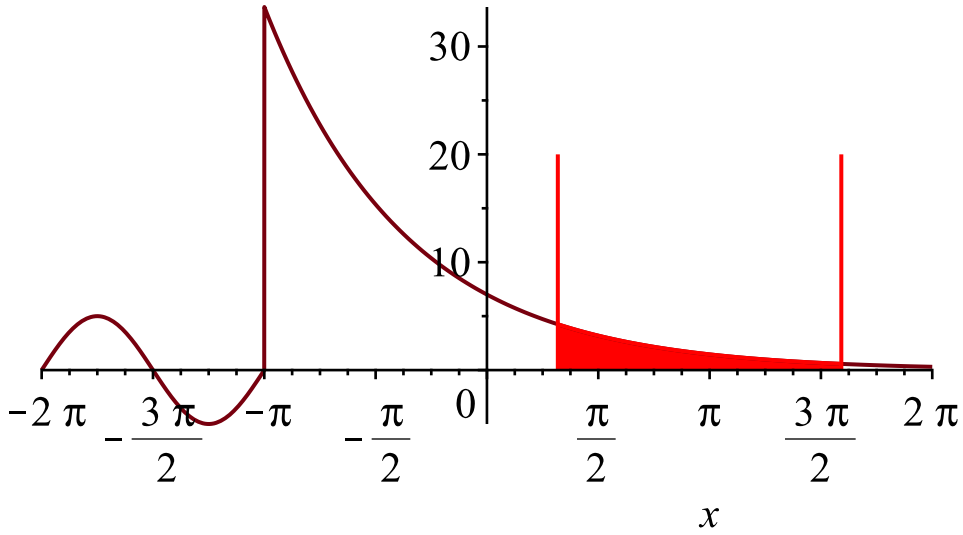
$$fint := \begin{cases} -2.500000000\cos(2.x) & x \le -3.141592654 \\ -14.\,e^{-0.5000000000x} + 64.84668333 & -3.141592654 < x \end{cases} \tag{17}$$

```
> #9.4
```

```
> plot([f, fdiff, fint], x = -10..10)
```



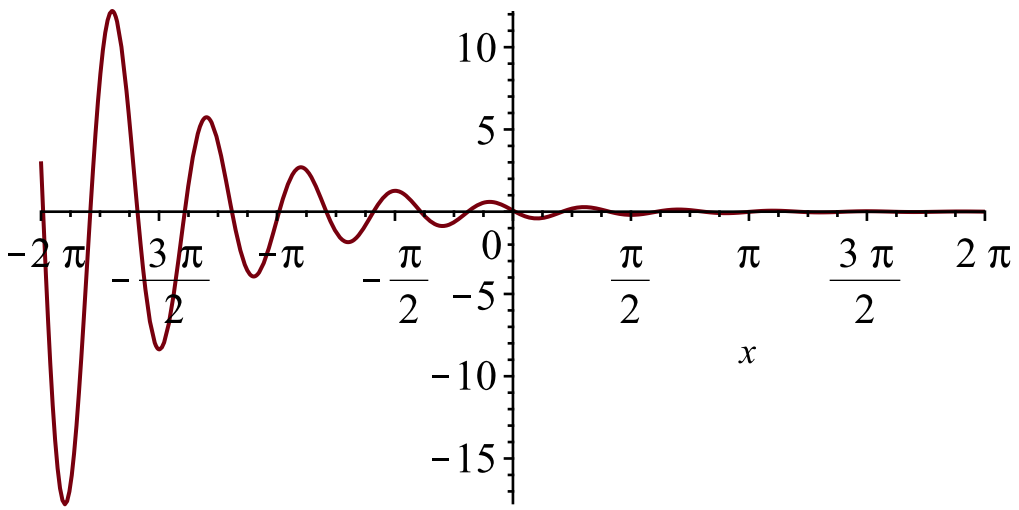

```
> #9.5
> g1 := plot(f):
> g2 := plot(f, x = 1..5, color = red, filled = true):
> a1 := plot([1, z, z = 0..20], color = red):
> a2 := plot([5, z, z = 0..20], color = red):
> plots[display](g1, g2, a1, a2);
```



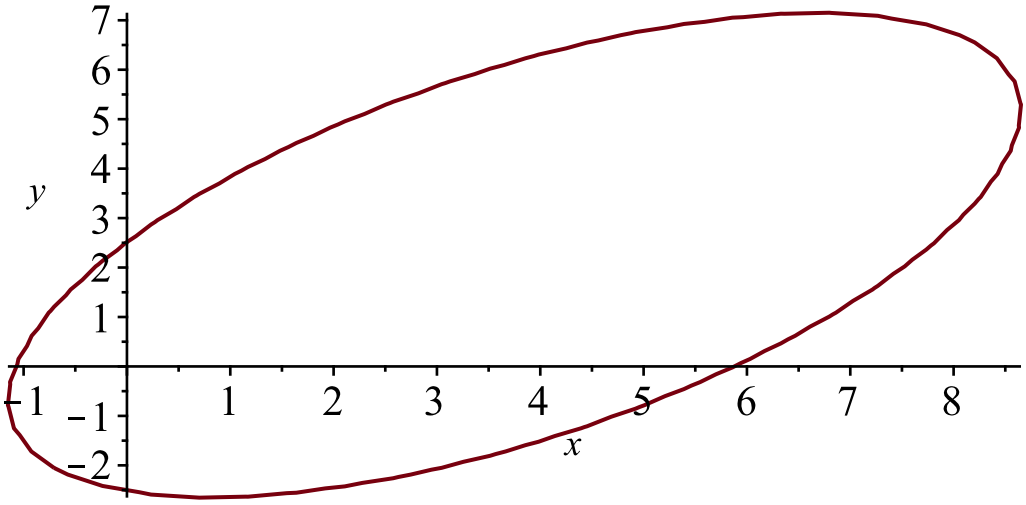

```
> int(f, x = 1..5)
```

7.342239255 **(18)**

```
> #10.1
> f := 0.5·exp(-0.6 x)·sin(5 x + 3):
> plot(f, x)
```




```
> #10.2
> f := 5*x^2 - 6*x*y + 5*y^2 - 24*x - 32 = 0 :
> plots[implicitplot](f, x = -10..10, y = -10..10)
```




```
> M := Matrix([[5, -3], [-3, 5]])
```

$$M := \begin{bmatrix} 5 & -3 \\ -3 & 5 \end{bmatrix} \tag{19}$$

```
> LinearAlgebra[Eigenvectors](M)
```

$$\begin{bmatrix} 2 \\ 8 \end{bmatrix}, \begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix} \tag{20}$$

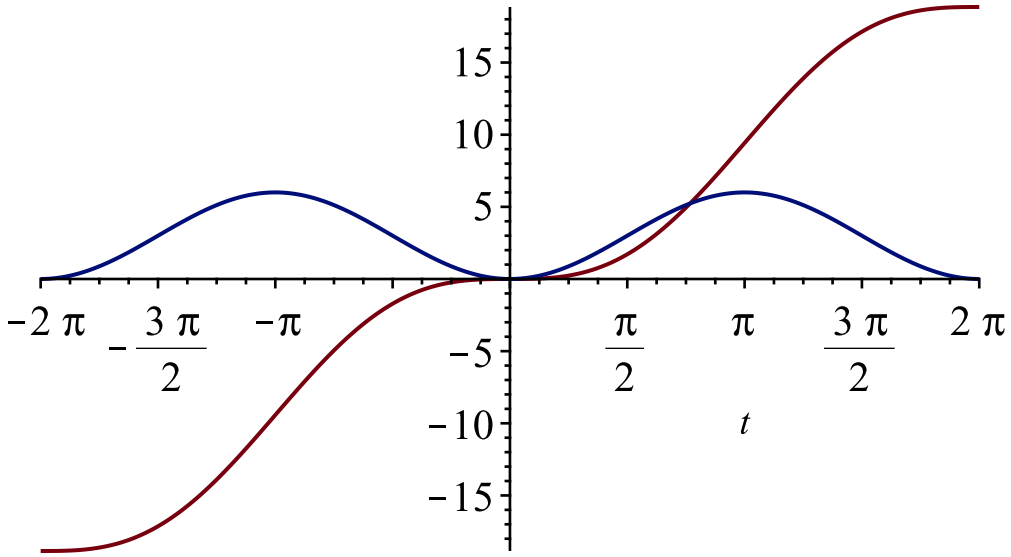
```
> LinearAlgebra[Normalize](Matrix([1, 1]), 2)
```

$$\begin{bmatrix} \frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2} \end{bmatrix} \tag{21}$$

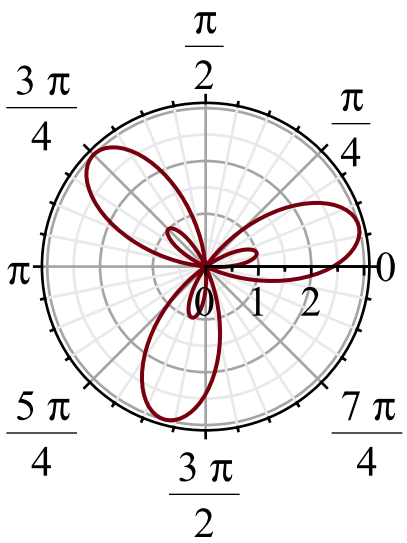
```
> LinearAlgebra[Normalize](Matrix([-1, 1]), 2)
```

$$\begin{bmatrix} -\frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2} \end{bmatrix} \tag{22}$$

```
> X := sqrt(2)/2 ·x + sqrt(2)/2 ·y :
> Y := -sqrt(2)/2 ·x + sqrt(2)/2 ·y :
> #10.3
> plot( [2·(t + sin(t)), 2·(1 − cos(t))])
```




```
> #10.4
> plots[polarplot]( 1 + 2 sin( 3 x + Pi/4 ), x )
```




```
>
```