

1a

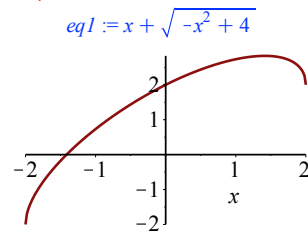
```
> int(arcsin(sqrt((x/(x+1))))), x=0..1);
```

$$-1 + \frac{1}{2} \pi$$

(1.1)

1b

```
> eq1:=x+sqrt(4-x^2);
> plot(eq1,x=-2..2);
```



```
> solve(diff(eq1,x),x);
```

$$\sqrt{2}$$

(2.1)

```
> subs(x=sqrt(2),eq1);
```

$$2\sqrt{2}$$

(2.2)

```
> evalf(2*sqrt(2)); #max
> subs(x=-2,eq1); #min
```

$$2.828427124$$

$$-2$$

(2.3)

2a

```
> A:=Matrix([[2,-1,1],[-1,2,-1],[1,-1,2]]);
> EE:=IdentityMatrix(3);
```

$$A := \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$$

$$EE := \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

(3.1)

```
> with(LinearAlgebra):
```

```
> A^2-5*A+4*EE;
```

(3.2)

$$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

(3.2)

```
> A^(-1);
```

$$\begin{bmatrix} \frac{3}{4} & \frac{1}{4} & -\frac{1}{4} \\ \frac{1}{4} & \frac{3}{4} & \frac{1}{4} \\ -\frac{1}{4} & \frac{1}{4} & \frac{3}{4} \end{bmatrix}$$

(3.3)

```
> (5*EE-A)/4;
```

$$\begin{bmatrix} \frac{3}{4} & \frac{1}{4} & -\frac{1}{4} \\ \frac{1}{4} & \frac{3}{4} & \frac{1}{4} \\ -\frac{1}{4} & \frac{1}{4} & \frac{3}{4} \end{bmatrix}$$

(3.4)

2b

```
> restart;
> A:=Matrix([[1,0,-1],[1,2,1],[0,2,3]]);
```

$$A := \begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 0 & 2 & 3 \end{bmatrix}$$

(4.1)

```
> with(LinearAlgebra):
```

```
> V,P:=Eigenvectors(A);
```

$$V,P := \begin{bmatrix} 2 \\ 2+\sqrt{3} \\ 2-\sqrt{3} \end{bmatrix}, \begin{bmatrix} -1 & -\frac{1}{1+\sqrt{3}} & -\frac{1}{1-\sqrt{3}} \\ -\frac{1}{2} & -\frac{1}{6}(-3+\sqrt{3})\sqrt{3} & \frac{1}{6}(-3-\sqrt{3})\sqrt{3} \\ 1 & 1 & 1 \end{bmatrix}$$

(4.2)

```
> simplify(P^(-1).A.P);
```

$$\begin{bmatrix} 2 & 0 & 0 \\ 0 & 2+\sqrt{3} & 0 \\ 0 & 0 & 2-\sqrt{3} \end{bmatrix}$$

(4.3)

3

```
> restart;
```

```

b:=2;
c:=3;
#eq1:=expand((b^x+c^x)*(10/b^x+3/c^x));
eq1:=expand((b^x+c^x)*(9/b^x+4/c^x));
      b:=2
      c:=3
      eq1:=13 + 4*2^x/3^x + 9*3^x/2^x
> eq2:=subs({b^x/c^x=X,c^x/b^x=1/X},eq1);
      eq2:=13 + 4X + 9/X
> plot(eq2,X=-4..4);

```

```

> sol1:=solve(diff(eq2,X)=0,X);
      sol1:=3/2, -3/2
> subs(X=sol1[1],eq2);
      25
> sol2:=solve(eq2=30,X);
      sol2:=17/8 + 1/8*sqrt(145), 17/8 - 1/8*sqrt(145)
> expand(sol2[1]*sol2[2]);
      9/4
> simplify(log[3/2](4/9));
      -2
> sol1:=solve(eq2=50,X);
      sol1:=9, 1/4
> eq3:=subs({X=b^x/c^x,1/x=c^x/b^x},eq2=50);
      eq3:=13 + 4*2^x/3^x + 9*3^x/2^x = 50

```

$$eq1 := 13 + \frac{4 \cdot 2^x}{3^x} + \frac{9 \cdot 3^x}{2^x} \quad (5.1)$$

$$eq2 := 13 + 4X + \frac{9}{X} \quad (5.2)$$

$$sol1 := \frac{3}{2}, -\frac{3}{2} \quad (5.3)$$

$$25 \quad (5.4)$$

$$sol2 := \frac{17}{8} + \frac{1}{8}\sqrt{145}, \frac{17}{8} - \frac{1}{8}\sqrt{145} \quad (5.5)$$

$$\frac{9}{4} \quad (5.6)$$

$$-2 \quad (5.7)$$

$$sol1 := 9, \frac{1}{4} \quad (5.8)$$

$$eq3 := 13 + \frac{4 \cdot 2^x}{3^x} + \frac{9 \cdot 3^x}{2^x} = 50 \quad (5.9)$$

```

> solve(eq3,x);
      2 ln(2)
      ln(3/2), - 2 ln(3)
      ln(3/2)

```

$$(5.10)$$

4

```

> restart;
b:=3;
c:=4;
(b^x+c^x)*(10/b^x+3/c^x);
eq1:=expand((b^x+c^x)*(10/b^x+3/c^x));
#eq1:=expand((b^x+c^x)*(9/b^x+4/c^x));
      b:=3
      c:=4
      eq1:=13 + 3*3^x/4^x + 10*4^x/3^x
> eq2:=subs({b^x/c^x=X,c^x/b^x=1/X},eq1);
      eq2:=13 + 3X + 10/X
> plot(eq2,X=-4..4);

```

```

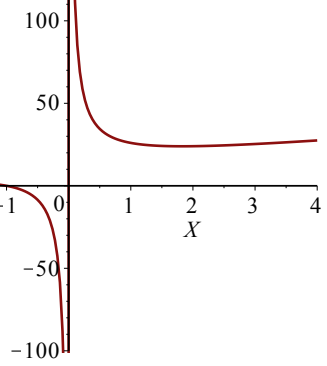
> sol1:=solve(diff(eq2,X)=0,X);
      sol1:=1/3*sqrt(30), -1/3*sqrt(30)
> subs(X=sol1[1],eq2);
      13 + 2*sqrt(30)
> sol2:=solve(eq2=30,X);

```

$$(3^x + 4^x) \left(\frac{10}{3^x} + \frac{3}{4^x} \right)$$

$$eq1 := 13 + \frac{3 \cdot 3^x}{4^x} + \frac{10 \cdot 4^x}{3^x} \quad (6.1)$$

$$eq2 := 13 + 3X + \frac{10}{X} \quad (6.2)$$



$$sol1 := \frac{1}{3}\sqrt{30}, -\frac{1}{3}\sqrt{30} \quad (6.3)$$

$$13 + 2\sqrt{30} \quad (6.4)$$

$$(6.5)$$

$$\text{sol2} := 5, \frac{2}{3} \quad (6.5)$$

```
> expand(sol2[1]*sol2[2]);
```

$$\frac{10}{3} \quad (6.6)$$

```
> simplify(log[4/3](10/3));
```

$$\frac{\ln(2) + \ln(5) - \ln(3)}{2 \ln(2) - \ln(3)} \quad (6.7)$$

```
> sol1:=solve(eq2=30,x);
```

$$\text{sol1} := 5, \frac{2}{3} \quad (6.8)$$

```
> eq3:=subs({X=b^x/c^x,1/x=c^x/b^x},eq2=30);
```

$$\text{eq3} := 13 + \frac{3 \cdot 3^x}{4^x} + \frac{10 \cdot 4^x}{3^x} = 30 \quad (6.9)$$

```
> solve(eq3,x);
```

$$\frac{\ln(5)}{\ln\left(\frac{3}{4}\right)}, -\frac{\ln\left(\frac{3}{2}\right)}{\ln\left(\frac{3}{4}\right)} \quad (6.10)$$

```
> evalf(solve(eq3,x));
```

$$-5.594501938, 1.409420839 \quad (6.11)$$