```
> restart;
> #Q1
> I1:=Int((1+u)^(1/3),u=1..2);
```

$$I1 := \int_{1}^{2} (1+u)^{1/3}\, du \tag{1}$$

```
> evalf(I1);
```

$$1.355179958 \tag{2}$$

```
> I2:=Int((cos(x)+sin(x)^2)/(sin(x)+cos(x)^2),x=0..Pi);
```

$$I2 := \int_{0}^{\pi} \frac{\cos(x) + \sin(x)^2}{\sin(x) + \cos(x)^2}\, dx \tag{3}$$

```
> evalf(I2);
```

$$1.437733305 \tag{4}$$

```
> I3:=Int(1/sqrt(1+y+y^2+y^3),y=0..1);
```

$$I3 := \int_{0}^{1} \frac{1}{\sqrt{1+y+y^2+y^3}}\, dy \tag{5}$$

```
> evalf(I3);
```

$$0.7375402314 \tag{6}$$

```
> I4:=Int(ln(t)^8,t=1..exp(1));
```

$$I4 := \int_{1}^{e} \ln(t)^8\, dt \tag{7}$$

```
> evalf(I4);
```

$$0.2743615330 \tag{8}$$

```
> #Q2
> B:=5^(2*n+2)/(2*n+2)!;
```

$$B := \frac{5^{2n+2}}{(2n+2)!} \tag{9}$$

```
> 0.5*10^(-4);
```

$$0.00005000000000 \tag{10}$$

```
> evalf(subs(n=8,B));
```

$$0.0005958254613 \tag{11}$$

```
> evalf(subs(n=9,B));
```

$$0.00003919904350 \tag{12}$$

```
> #Q3
> f:=2*cos(t)+cos(5*t);
  g:=3*sin(t);
  df:=diff(f,t);
  dg:=diff(g,t);
  ddf:=diff(df,t);
  ddg:=diff(dg,t);
```

$$f := 2\cos(t) + \cos(5t)$$

$$g := 3\sin(t)$$

$$df := -2\sin(t) - 5\sin(5t)$$

$$dg := 3\cos(t)$$
$$ddf := -2\cos(t) - 25\cos(5t)$$
$$ddg := -3\sin(t) \quad (13)$$

```
> L:=Int(sqrt(df^2+dg^2),t=0..2*Pi);
```

$$L := \int_0^{2\pi} \sqrt{(-2\sin(t) - 5\sin(5t))^2 + 9\cos(t)^2}\, dt \quad (14)$$

```
> evalf(L);
```

$$25.51562749 \quad (15)$$

```
> A:=Int(dg*f,t=0..2*Pi);
```

$$A := \int_0^{2\pi} 3\cos(t)\,(2\cos(t) + \cos(5t))\, dt \quad (16)$$

```
> evalf(A);
```

$$18.84955592 \quad (17)$$

```
> t0:=arcsin(sqrt(2)/2);
```

$$t0 := \frac{1}{4}\pi \quad (18)$$

```
> m:=subs(t=t0,dg/df);
```

$$m := \frac{3\cos\left(\frac{1}{4}\pi\right)}{-2\sin\left(\frac{1}{4}\pi\right) - 5\sin\left(\frac{5}{4}\pi\right)} \quad (19)$$

```
> simplify(m);
```

$$1 \quad (20)$$

```
> kappa:=(ddg*df-dg*ddf)/(df^2+dg^2)^(3/2);
```

$$\kappa := \frac{-3\sin(t)\,(-2\sin(t) - 5\sin(5t)) - 3\cos(t)\,(-2\cos(t) - 25\cos(5t))}{\left((-2\sin(t) - 5\sin(5t))^2 + 9\cos(t)^2\right)^{3/2}} \quad (21)$$

```
> simplify(subs(t=t0,kappa));
```

$$-\frac{13}{9} \quad (22)$$

```
> #Q6
> f:=4*sin(x);
  g:=sqrt(6)-sqrt(2);
```

$$f := 4\sin(x)$$
$$g := \sqrt{6} - \sqrt{2} \quad (23)$$

```
> a:=solve(f=g,x);
```

$$a := \arcsin\left(\frac{1}{4}\sqrt{6} - \frac{1}{4}\sqrt{2}\right) \quad (24)$$

```
> evalf(a-Pi/12);
```

$$2.\ 10^{-10} \quad (25)$$

```
> # The exact value of a
  a:=Pi/12;
```

$$a := \frac{1}{12}\pi \quad (26)$$

```
> b:=Pi-a;
```

$$b := \frac{11}{12}\pi \quad (27)$$

```
> Vx:=Int(Pi*(f^2-g^2),x=a..b);
```

$$Vx := \int_{\frac{1}{12}\pi}^{\frac{11}{12}\pi} \pi\left(16\sin(x)^2 - \left(\sqrt{6}-\sqrt{2}\right)^2\right) dx \quad (28)$$

```
> Vx2:=value(Vx);
```

$$Vx2 := 16\pi\sin\left(\frac{1}{12}\pi\right)\cos\left(\frac{1}{12}\pi\right) + \frac{10}{3}\sqrt{3}\pi^2 \quad (29)$$

```
> trig1:=sin(Pi/12)=sqrt((1-cos(Pi/6))/2);
  trig2:=cos(Pi/12)=sqrt((1+cos(Pi/6))/2);
```

$$trig1 := \sin\left(\frac{1}{12}\pi\right) = \frac{1}{4}\sqrt{6} - \frac{1}{4}\sqrt{2}$$

$$trig2 := \cos\left(\frac{1}{12}\pi\right) = \frac{1}{4}\sqrt{6} + \frac{1}{4}\sqrt{2} \quad (30)$$

```
> Vx3:=subs([trig1,trig2],Vx2);
```

$$Vx3 := 16\pi\left(\frac{1}{4}\sqrt{6} - \frac{1}{4}\sqrt{2}\right)\left(\frac{1}{4}\sqrt{6} + \frac{1}{4}\sqrt{2}\right) + \frac{10}{3}\sqrt{3}\pi^2 \quad (31)$$

```
> simplify(Vx3);
```

$$4\pi + \frac{10}{3}\sqrt{3}\pi^2 \quad (32)$$

```
> evalf(Vx3);
```

$$69.54855822 \quad (33)$$

```
> Vy:=Int(2*Pi*x*(f-g),x=a..b);
```

$$Vy := \int_{\frac{1}{12}\pi}^{\frac{11}{12}\pi} 2\pi x\left(4\sin(x) - \sqrt{6} + \sqrt{2}\right) dx \quad (34)$$

```
> Vy2:=value(Vy);
```

$$Vy2 := \frac{5}{6}\sqrt{2}\pi^3 + 8\cos\left(\frac{1}{12}\pi\right)\pi^2 - \frac{5}{6}\sqrt{2}\sqrt{3}\pi^3 \quad (35)$$

```
> Vy3:=subs([trig1,trig2],Vy2);
```

$$Vy3 := \frac{5}{6}\sqrt{2}\pi^3 + 8\left(\frac{1}{4}\sqrt{6} + \frac{1}{4}\sqrt{2}\right)\pi^2 - \frac{5}{6}\sqrt{2}\sqrt{3}\pi^3 \quad (36)$$

```
> factor(Vy3);
```

$$\frac{1}{6}\pi^2\left(5\sqrt{2}\pi - 5\sqrt{2}\sqrt{3}\pi + 12\sqrt{6} + 12\sqrt{2}\right) \quad (37)$$

```
> evalf(Vy3);
```

$$49.51639654 \quad (38)$$

```
> evalf(sqrt(2)/6*Pi^2*(5*Pi*(1-sqrt(3))+12*(1+sqrt(3))));
```

$$49.51639658 \quad (39)$$

```
> #Q7
> limit((sin(x)-x*cos(x))/x^3,x=0);
```

$$\frac{1}{3} \tag{40}$$