VERSION B

```
Warning, new definition for norm
Warning, new definition for trace
Package:   vec_calc   Version 4.3
For all HELP, execute: ?vec_calc
To use aliases, execute:   vc_aliases;
```

I, *Point*, *MF*, *Cv*, *Ca*, *Cj*, *CT*, *CN*, *CB*, *Ck*, *Ct*, *CL*, *CaT*, *CaN*, *Cforget*, *d2r*, *r2d*, *p2r*, *r2p*, *c2r*, *r2c*, *s2r*, *r2s*, *s2c*, *c2s*, *Muint*, *muint*, *LPMD*, *Lis*, *lis*, *Liv*, *liv*, *Sis*, *sis*, *Siv*, *siv*

#1 B

```
> tan(arccos(4/5));
```

$$\frac{3}{4}$$

#2 A

```
> f:=x->x^3-3*x^2+2;
  crit:=solve(D(f)(x)=0,x); #NOTE 4/3 is outside the interval!!!
  f_neg1:=f(-1), minimum;
  f_0:=f(0);
  f_2:=f(2);
  f_3:=f(3);
```

$$f := x \rightarrow x^3 - 3\,x^2 + 2$$

$$crit := 0, 2$$

$$f\_neg1 := -2, minimum$$

$$f\_0 := 2$$

$$f\_2 := -2$$

$$f\_3 := 2$$

#3 D antiderivatives differ only by the addition of an arbitrary constant (i.e., F(x)+C)

#4 A

```
> f:=x->exp(ln(x));
  f_of_x=simplify(f(x));
  (D@@2)(f)(x);
```

$$f := x \rightarrow \mathbf{e}^{\ln(x)}$$

$$f\_of\_x = x$$

$$0$$

#5 D

```
> f:=x->ln(x)/x;
  df:=D(f)(x);
  solve(df<0,x);
```

$$f := x \rightarrow \frac{\ln(x)}{x}$$

$$df := \frac{1}{x^2} - \frac{\ln(x)}{x^2}$$

$$\text{RealRange}(\text{Open}(\mathbf{e}), \infty)$$

#6 B

```
> df:=x->4*x^3-6*x^2;
```

```
  f:=unapply(int(df(x),x)+C,x);
  solve(f(1)=2,C); subs(C=%,x=2,f(x));
```

$$df := x \to 4\,x^3 - 6\,x^2$$

$$f := x \to x^4 - 2\,x^3 + C$$

$$3$$

$$3$$

#7 E

```
> y:=x->arctan(exp(x));
  D(y)(x);
  simplify(%);
```

$$y := x \to \arctan(\mathbf{e}^x)$$

$$\frac{\mathbf{e}^x}{1 + (\mathbf{e}^x)^2}$$

$$\frac{\mathbf{e}^x}{1 + \mathbf{e}^{(2\,x)}}$$

#8 C: Mean Value Theorem with a=0, b=1

#9 B: move sec x to denominator as cos x and apply L'Hospital's Rule

```
> Limit((Pi/2-x)*sec(x),x=Pi/2);
  value(%);
```

$$\lim_{x \to (1/2\,\pi)} \left(\frac{1}{2}\pi - x\right)\sec(x)$$

$$1$$

#10 E Use logarithmic differentiation

```
> y:=x->x^sin(x);
  D(y)(x);
```

$$y := x \to x^{\sin(x)}$$

$$x^{\sin(x)}\left(\cos(x)\ln(x) + \frac{\sin(x)}{x}\right)$$

#11 B

```
> Sum(cos(n*Pi)^2,n=1..15);
  value(%);
```

$$\sum_{n=1}^{15} \cos(n\,\pi)^2$$

$$15$$

#12 E f increasing (-∞ ,-2), (3,5); f decreasing (-2,3), (5, ∞); local max x=-2, 5; local min x=3

#13

```
> V:=x->x*(3-2*x)*(4-2*x);
  dV:=D(V)(x);
  solve(dV=0,x);
  tests:=V_0=V(0),V_crit=evalf(V(%[2]))*max,V_threehalves=V(3/2);
```

$$V := x \to x\,(3 - 2\,x)\,(4 - 2\,x)$$

$$dV := (3-2x)(4-2x) - 2x(4-2x) - 2x(3-2x)$$

$$\frac{7}{6}+\frac{1}{6}\sqrt{13}, \frac{7}{6}-\frac{1}{6}\sqrt{13}$$

$$tests := V\_0 = 0, V\_crit = 3.032302468\ max, V\_threehalves = 0$$

#14

```
> a:='a':b:='b':c:='c':
  a14:=Limit(ln(a+exp(c*x))/(b*x),x=infinity)=c/b;
  b:=Limit(cos(2*x)^(3/x),x=0,right)=limit(cos(3*x)^(5/x),x=0,right)
  ;
```

$$a14 := \lim_{x \to \infty} \frac{\ln(a+\mathbf{e}^{(c\,x)})}{b\,x} = \frac{c}{b}$$

$$b := \lim_{x \to 0+} \cos(2\,x)^{\left(3\frac{1}{x}\right)} = 1$$

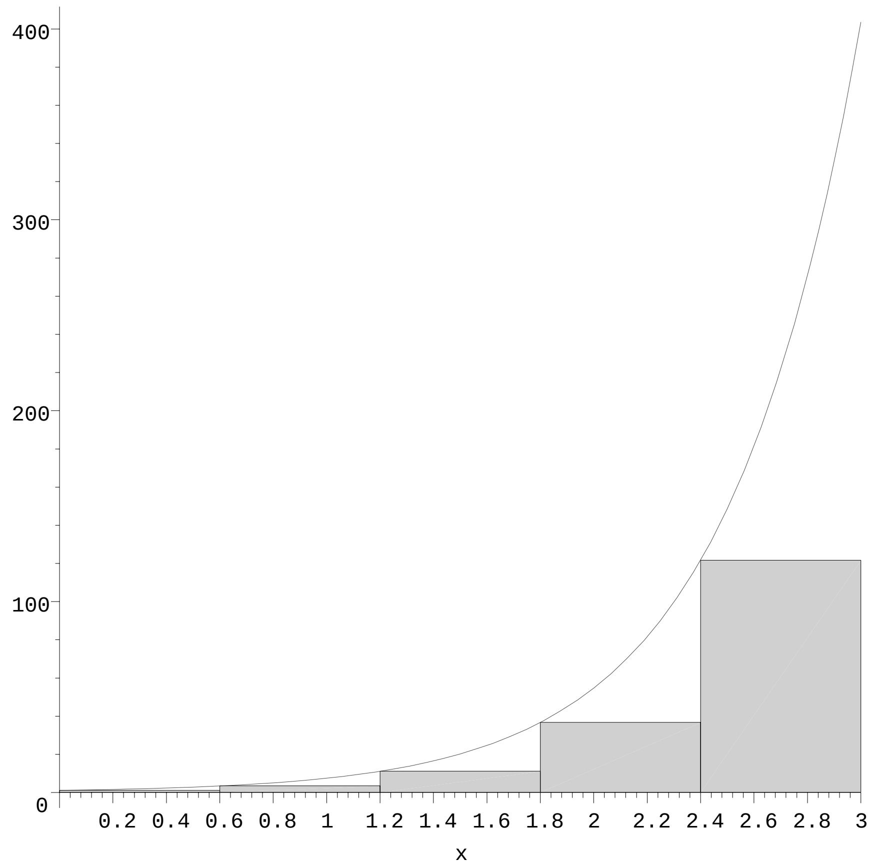
#15

```
> f:=x->exp(2*x);
  a:=P={0,3/5,6/5,9/5,12/5,3};
  b:=approximation=value(leftsum(f(x),x=0..3,5));
  leftbox(f(x),x=0..3,5);
  d:=underestimate;
```

$$f := x \to \mathbf{e}^{(2\,x)}$$

$$a := P = \{0, 3, \frac{3}{5}, \frac{6}{5}, \frac{9}{5}, \frac{12}{5}\}$$

$$b := approximation = \frac{3}{5} + \frac{3}{5}\mathbf{e}^{(6/5)} + \frac{3}{5}\mathbf{e}^{(12/5)} + \frac{3}{5}\mathbf{e}^{(18/5)} + \frac{3}{5}\mathbf{e}^{(24/5)}$$



$$d := underestimate$$

#16

a) -2, -1, 2 (where f'=0 or does not exist)

b) (-4,1) or (2, 4) (where f'>0)

c) (-2,0) or (2,4) (where f' increasing)

d) -2, 0, 2 (where f' changes direction)

#17

```
> y:=x->C*exp(k*t);
  a:=subs(C=6000,k=ln(2)/25,y(x));
  b:=evalf(subs(t=40,a));
  c:=evalf(solve(a=100000,t));
```

$$y := x \rightarrow C\, \mathbf{e}^{(k\, t)}$$

$$a := 6000\, \mathbf{e}^{(1/25 \ln(2)\, t)}$$

$$b := 18188.59880$$

$$c := 101.4723422$$

```
>
```