AP Calculus 2018 Prob

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Problem78

```
syms f(t)

f(t) = 65 - 8*sin(pi*t/12)
```

f(t) =

$$65 - 8\sin\left(\frac{\pi t}{12}\right)$$

```
ans = int(f(t), t, [3, 6]) / 3
```

ans =

$$65 - \frac{16\sqrt{2}}{\pi}$$

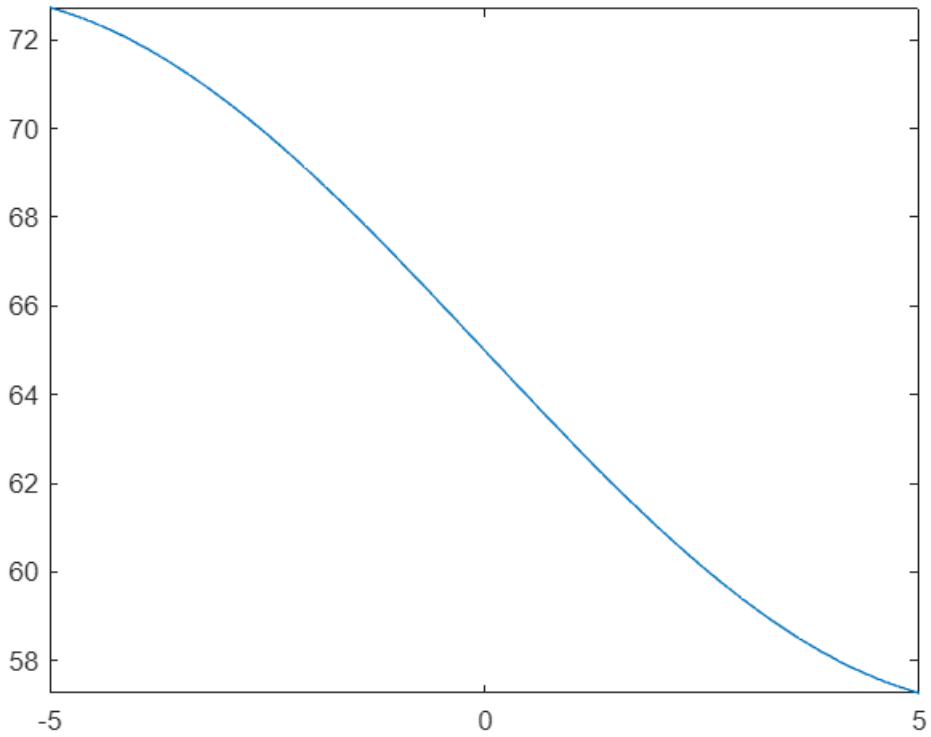
```
vpa(ans)
```

ans = 57.797469470743151443558406471946

```
graph1 = @(t) 65 - 8*sin(pi*t/12)
```

```
graph1 = function_handle with value:
    @(t)65-8*sin(pi*t/12)
```

```
fplot(graph1)
```



Problem80

```
syms f(x)
f(x) = (x^2 + 1)*sin(3*x -1 )
```

f(x) = $\sin(-1+3\,x)\,(1+x^2)$

```
prob80(x) = diff(f(x), x)
```

prob80(x) = $3\cos(-1+3\,x)\,(1+x^2)+2\,x\sin(-1+3\,x)$

```
y = -100:1:100
```

```
y = 1×201
  -100   -99   -98   -97   -96   -95   -94   -93   -92   -91   -90   -89   -88 ···
```

```
vpa(prob80([-0.240]))
```

ans = 0.00302814586127405635522090756623 86

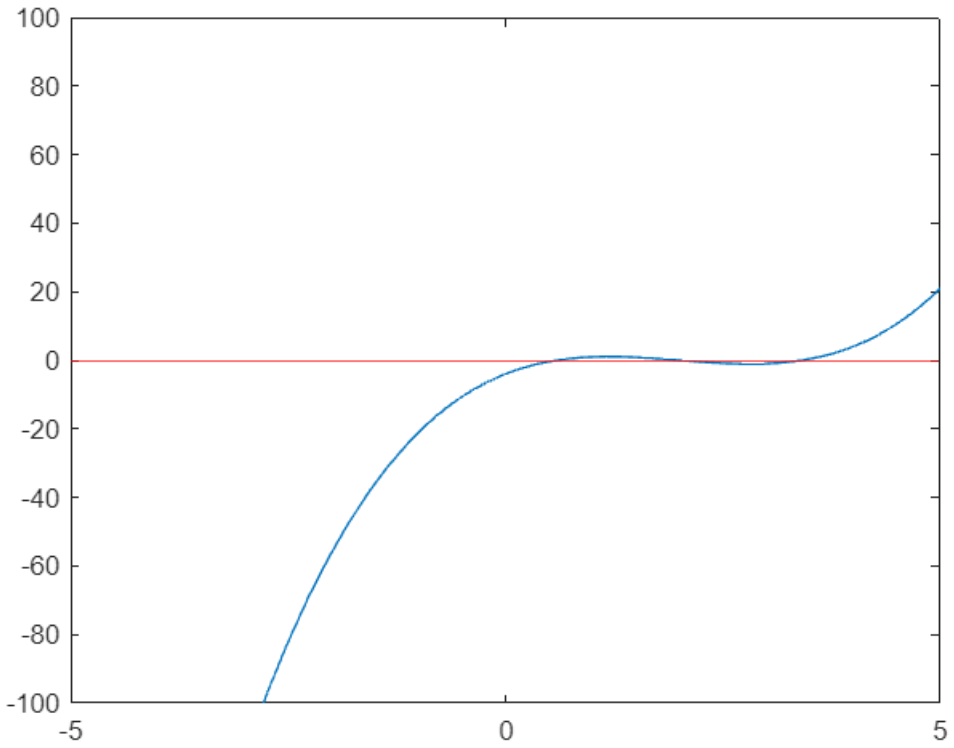
Prob81

```
syms v(t)
```

```
v(t) = t^3 - 6*t^2 + 10*t -4
```

v(t) = $-4 + 10\,t - 6\,t^2 + t^3$

```
fplot(v(t))
yline(0, Color='r')
ylim([-100, 100])
```



Problem83

```
syms x(t) y(t)
x(t) = t*cos(t/2)
```

x(t) =

$t\cos\left(\frac{t}{2}\right)$

```
y(t) = sqrt(t^2 + 2*t)
```

y(t) = $\sqrt{2\,t + t^2}$

```
p(t) = [diff(x(t),1), diff(y(t), 1)]
```

p(t) =

$$\left(\cos\left(\frac{t}{2}\right)-\frac{t\sin\left(\frac{t}{2}\right)}{2}\quad\frac{2+2t}{2\sqrt{2t+t^2}}\right)$$

```
vpa(norm(p(1)))
```

ans = 1.319170650685474230935382954067 7

Problem 86

```
syms f(x) g(x)

f(x) = 4*cos(pi*x/4)
```

f(x) =

$$4\cos\left(\frac{\pi x}{4}\right)$$

```
g(x) = (x-2)^2
```

g(x) = $(-2+x)^2$

```
ans = int((f(x) - g(x))^2/2, x, [0, 2])
```

ans =

$$\frac{56}{5}-\frac{256\pi-512}{\pi^3}$$

```
vpa(ans)
```

ans = 1.774562617359668972790948394854 3

```

```

```
syms x
f(x) = 2^(-x^2)
```

f(x) =

$$\frac{1}{2^{x^2}}$$

```
int(f(x), x)
```

ans =

$$\frac{\sqrt{\pi}\ \mathrm{erf}\left(x\sqrt{\log(2)}\right)}{2\sqrt{\log(2)}}$$

```
sqrt(16.25)
```

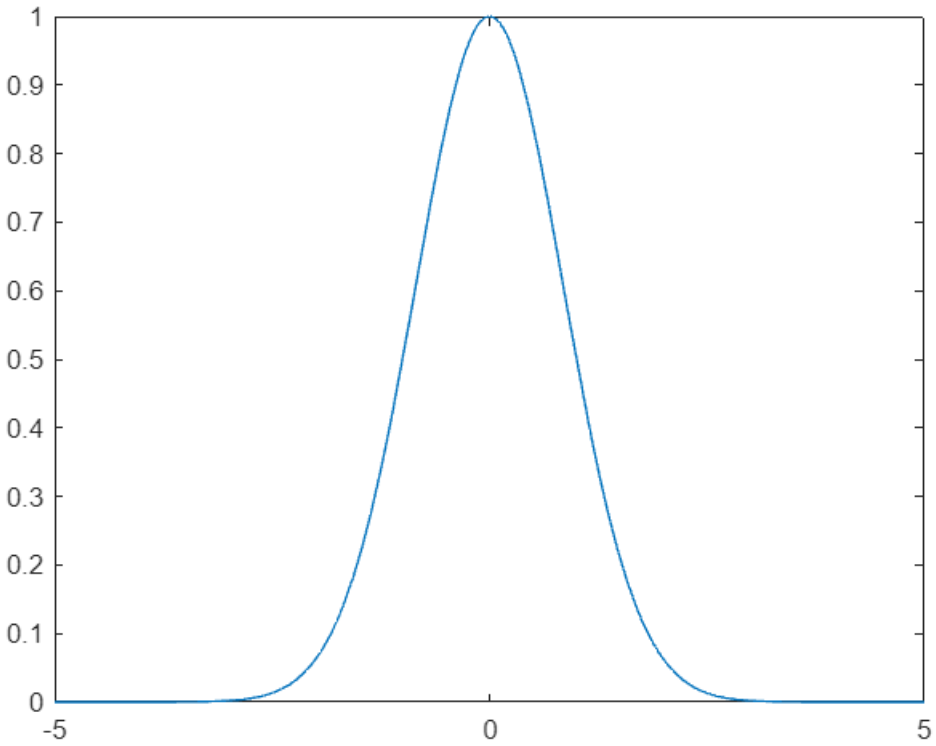
```
ans = 4.0311
```

```
f = @(x) 2^(-x^2)
```

```
f = function_handle with value:
    @(x)2^(-x^2)
```

```
fplot(f)
```

```
Warning: Function behaves unexpectedly on array inputs. To improve performance, properly vectorize your
function to return an output with the same size and shape as the input arguments.
```




```
ans = vpa(int(f, x, [0,1]))
```

```
ans = 0.810025454390955826629285266724 65
```

```
sqrt(16 + (1/2 + ans)^2)
```

```
ans = 4.209057696343948940321498390230 2
```

```

```

Using Euler's Estimation

```
2^(-1/4)
```

```
ans = 0.8409
```

```
sqrt(16 + 1.42^2)
```

```
ans = 4.2446
```

```
int(cos(t^2), t)
```

```
ans =
```

$$\frac{\sqrt{2}\ \sqrt{\pi}\ \mathrm{C}\left(\frac{\sqrt{2}\ t}{\sqrt{\pi}}\right)}{2}$$

```
vpa(int(cos(t^2), t, [0, 2]) + 1)
```

```
ans = 1.461461462433216372866474155527 8
```

```
syms t
eqn = cos(t^2)
```

```
eqn = cos(t^2)
```

```
int(eqn, t)
```

```
ans =
```

$$\frac{\sqrt{2}\ \sqrt{\pi}\ \mathrm{C}\left(\frac{\sqrt{2}\ t}{\sqrt{\pi}}\right)}{2}$$

FRQ2

```
%partc
expr = exp(t)*sin(t^2)/cos(t^2)
```

```
expr =
```

$$\frac{\sin(t^2)\,\mathrm{e}^t}{\cos(t^2)}$$

```
vpa(subs(expr, t, 2))
```

```
ans = 8.555206407816852647915941256 2046
```

```
%partd
syms t
f1 = cos(t^2)
```

```
f1 = cos(t^2)
```

```
f2 = exp(t)*sin(t^2)
```

f2 = $\sin(t^2)\,e^t$

```
a1 = diff(f1,t)
```

a1 = $-2\,t\sin(t^2)$

```
a2 = diff(f2, t)
```

a2 = $\sin(t^2)\,e^t + 2\,t\cos(t^2)\,e^t$

```
vpa(subs(a1, t, 2))
```

ans = 3.027209981231713005490556378047 3

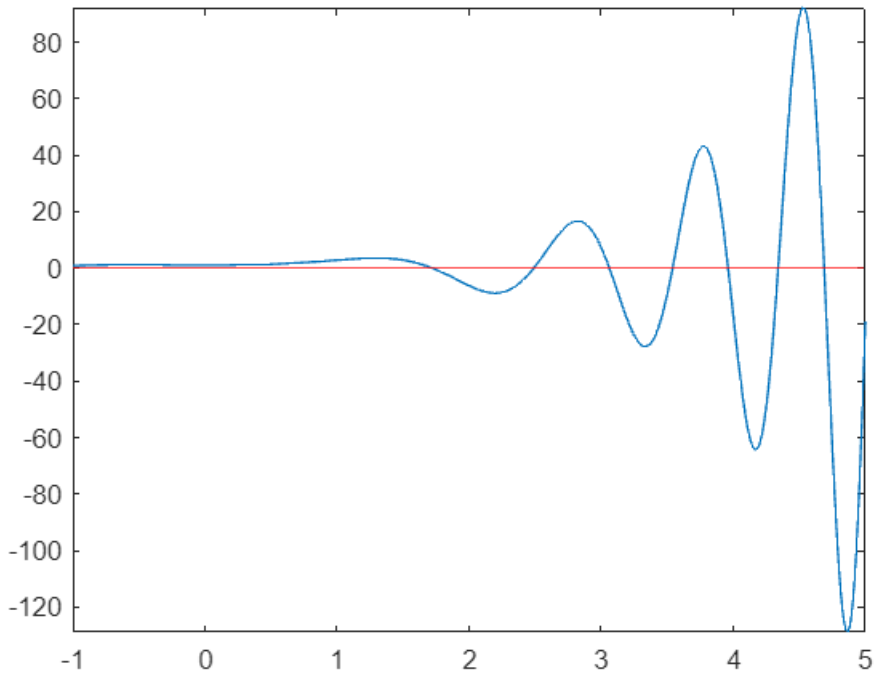
```
vpa(subs(a2, t, 2))
```

ans = −24.911293626718522961596117459012

```
%for speed
vpa(norm(subs([f1, f2], t, 2)))
```

ans = 5.630128003653463385263511109489

```
fplot(f1+f2)
yline(0, 'r')
xlim([-1, 5])
```



```
vpasolve(f1+f2 == 0, 2)
```

ans = 1.721837062059297771415980683224 8