Solution 23.13

(a) Create the M-file function:

```
function y=f(t)
y=9.81*70/12*(1-exp(-12/70*t));
```

Then implement the following MATLAB session:

```
>> Q=quad(@f,0,10)
Q =

  298.5546
```

(b)

$$d(t) = \frac{gm}{c}\int_0^t \left(1 - e^{-(c/m)t}\right)\, dt$$

$$d(t) = \frac{gm}{c}\left[t + \frac{m}{c}e^{-(c/m)t}\right]_0^t$$

$$d(10) = \frac{9.81(70)}{12}\left[10 + \frac{70}{12}e^{-(12/70)10} - 0 - \frac{70}{12}\right] = 298.5546$$

(c) Implement the following MATLAB session:

```
>> x=[9.99 10.01];
>> y=f(x);
>> d=diff(y)./diff(x)

d =
    1.7667
```

(d)

$$a(t) = \frac{gm}{c}\frac{d}{dt}\left(1 - e^{-(c/m)t}\right)$$

$$a(t) = ge^{-(c/m)t}$$

$$a(10) = 9.81e^{-(12/70)10} = 1.766706$$