HW 12

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2b)

```
clear t y;
a=0; b=1; N=10; y0=0; h=(b-a)/N;
t(1)=a;
y(1)=exp(1);
exact = @(t) exp(-10*t + 1) + t;
f = @(t, y) -10*y + 10*t + 1;
for n=1:N
t(n+1)=t(n)+h;
y(n+1)=y(n)+h*f(t(n),y(n));
end
t = t';
approx = y(:); true = exact(a:h:b)'; diff = abs(y(:) - true);
table(t, approx, true, diff)
```

```
ans =

     t      approx      true         diff
    ___    _______    ________    __________

      0     2.7183      2.7183             0
    0.1        0.1         1.1             1
    0.2        0.2     0.56788       0.36788
    0.3        0.3     0.43534       0.13534
    0.4        0.4     0.44979      0.049787
    0.5        0.5     0.51832      0.018316
    0.6        0.6     0.60674     0.0067379
    0.7        0.7     0.70248     0.0024788
    0.8        0.8     0.80091    0.00091188
    0.9        0.9     0.90034    0.00033546
      1          1      1.0001    0.00012341
```

4b)

```
clear t y;
f = @(t, y) -10*y + 10*t + 1;
```

```
[w, t_i] = RK4(f, [0 1], exp(1), 10);
diff = abs(w - true);
table(t_i, w, true, diff)
```

```
ans =

    t_i       w        true         diff
    ___    _______    _______    __________

      0     2.7183     2.7183             0
    0.1     1.1194        1.1      0.019356
    0.2    0.58226    0.56788      0.014379
    0.3    0.44335    0.43534     0.0080116
    0.4    0.45376    0.44979      0.003968
    0.5    0.52016    0.51832     0.0018425
    0.6    0.60756    0.60674    0.00082136
    0.7    0.70283    0.70248    0.00035599
    0.8    0.80106    0.80091    0.00015115
    0.9     0.9004    0.90034    6.3173e-05
      1     1.0001     1.0001    2.6078e-05
```

6b)

```
clear t y w;
f = @(t, y) -10*y + 10*t + 1;
[w, t_i] = Adams4PC(f, [0 1], exp(1), 10);
diff = abs(w - true);
table(t_i, w, true, diff)
```

```
ans =

    t_i       w        true         diff
    ___    _______    _______    _________

      0     2.7183     2.7183             0
    0.1     1.1194        1.1      0.019356
    0.2    0.58226    0.56788      0.014379
    0.3    0.44335    0.43534     0.0080116
    0.4    0.39112    0.44979      0.058663
    0.5    0.45329    0.51832      0.065029
    0.6    0.59712    0.60674     0.0096189
    0.7    0.70642    0.70248      0.003938
    0.8    0.78269    0.80091      0.018223
    0.9    0.88845    0.90034      0.011882
      1     1.0082     1.0001     0.0080779
```

8b)

```
clear t y w;
```

```
df = @(t, y) -10;
[w, t_i, flg] = TrapNewton(f, df, [0 1], exp(1), 10, 100, 10^-5);
diff = abs(w - true);
table(t_i, w, true, diff)
```

```
ans =

    t_i       w        true         diff
    ___    _______    _______    __________

      0     2.7183     2.7183             0
    0.1     1.0061        1.1      0.093906
    0.2    0.50203    0.56788      0.065848
    0.3    0.40068    0.43534      0.034658
    0.4    0.43356    0.44979      0.016228
    0.5    0.51119    0.51832     0.0071293
    0.6    0.60373    0.60674     0.0030092
    0.7    0.70124    0.70248     0.0012358
    0.8    0.80041    0.80091    0.00049757
    0.9    0.90014    0.90034    0.00019736
      1          1     1.0001    7.7375e-05
```

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