1. Look to the formula for the closed-loop system. The coefficient of s is $\frac{\tau}{1+K_C K_F}$, so the new tau value is

```
ans = 0.6757
```

2. In the system with a proportional controller, the steady-state output is 0.5. With the PID controller, the final output is 1.

3. This is a Type 1 system (s^1 in the denominator), so the SSE for a step input will be 0 and the SSE for a parabolic input will be ∞. The SSE for the ramp input is

kv =
$$\frac{1}{6}$$

error = 6

4. This is a unity feedback system with a disturbance, so use appropriate equation. Input and dist are given in the time domain, so need to convert those to s notation before calcuating the SSE

sse =
$$\frac{13}{37}$$

5. Have to solve this one "backwards". You know the SSE and that all s go to 0, so solve for K. Pay attention to input, which is 10, not unit.

k = 10000

6. First find T(s) then find location of poles

t =
$$\frac{240}{s^4 + 10\,s^3 + 35\,s^2 + 50\,s + 264}$$

```
ans = 4×1 complex
  -5.3948 + 2.6702i
  -5.3948 - 2.6702i
   0.3948 + 2.6702i
   0.3948 - 2.6702i
```

Two of the poles are in the RHP, so the system is unstable

7.

```
Gm = 4.8000e+03
Pm = Inf
Wgm = 6.6333
Wpm = NaN
```

```
Gm = 480.0003
Pm = Inf
Wgm = 6.6333
Wpm = NaN

Gm = 4.8000
Pm = 72.7213
Wgm = 6.6333
Wpm = 2.5446
```

Final gain margins are 4800, 480 and 4.8 for (a), (b), and (c).