Math 2250−1
Week 11 concepts and homework, due November 9 **Wednesday**.
Thursday exam will cover this material.

Recall that problems which are underlined are good for seeing if you can work with the underlying concepts; that the underlined problems are to be handed in. There is no Friday quiz for this week, because of the exam on Thursday.

10.1: Laplace transforms and inverse transforms.

Use the definition of Laplace transform, linearity, and integration techniques to compute Laplace transforms of f(t):
1, 3, 7, **8, 10**
Use Laplace transform table and linearity to compute Laplace transforms:
16, 20
Use Laplace transform table and linearity to compute inverse Laplace transforms of F(s):
23, **28**

10.2: Transforming and solving initial value problems via Laplace transforms:
3, **4**, 5, **6**, **10**.

10.3: partial fractions to simplify F(s), and the translation theorem with completing the square, to identify inverse Laplace transforms; applying these techniques to initial value problems.
3, 7, **8,** 17, **20**, **30**, **32**, **34.**

w11.1) With access to a Laplace transform table it is possible to very quickly recover the general solutions to our key mechanical oscillation problems. Do this for
w11.1a) undamped forced oscillation, $\omega \neq \omega_0$:

$$x''(t) + \omega_0^2 \cdot x(t) = \frac{F_0}{m} \cdot \cos(\omega \cdot t)$$
$$x(0) = x_0$$
$$x'(0) = v_0$$

w11.1b) *undamped forced oscillation,* $\omega = \omega_0$:

$$x''(t) + \omega_0^2 \cdot x(t) = \frac{F_0}{m} \cdot \cos(\omega_0 \cdot t)$$
$$x(0) = x_0$$
$$x'(0) = v_0$$

Notes: Maple can check partial fractions, Laplace transforms, and inverse Laplace transforms:

```
> with(inttrans) : # to see the integral transform list in this library replace : with ;
> f1 := t→t·exp(3·t)·cos(4·t);
  laplace( f1(t), t, s); # for more info on this command use help windows
```

$$f1 := t \rightarrow t\, e^{3t} \cos(4\, t)$$

$$\frac{s^2 - 6\, s - 7}{\left((s-3)^2 + 16\right)^2} \quad \textbf{(1)}$$

> $F1 := s \to \frac{s^2 - 6\,s - 7}{\left((s-3)^2 + 16\right)^2};$
invlaplace$(F1(s), s, t);$

$$F1 := s \to \frac{s^2 - 6\,s - 7}{\left((s-3)^2 + 16\right)^2}$$

$$t\,\mathrm{e}^{3\,t}\cos(4\,t) \qquad \textbf{(2)}$$

> convert$(F1(s), parfrac, s);$

$$\frac{1}{s^2 - 6\,s + 25} - \frac{32}{\left(s^2 - 6\,s + 25\right)^2} \qquad \textbf{(3)}$$

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