جامعة الفيوم — اختبار الفصل الدراسي الأول — الفرقة الرابعة (تخلف)
كلية التربية — المعادلات التفاضلية الجزئية — للعام الدراسي 2011/2010
قسم الرياضيات — شعبة فيزياء- نظام قديم — الزمن/ثلاث ساعات

Answer the following questions:

1. a) Transform the equation:

$$e^{2x}u_{xx} + 2e^{x+y}u_{xy} + e^{2y}u_{yy} = 0$$

To its canonical form.

b) Find the Laplace Transform of the functions:

i) $t\sin 3t$ ii) $\frac{\sin t}{t}$ iii) t^2e^{3t}

---

2. a) Find the inverse Laplace Transform of the functions:

i) $\frac{s}{(s-1)^2(s+2)}$ ii) $\frac{s^2+2s-4}{(s+1)(s-2)(s-4)}$

b) Use the convolution theorem to find $L^{-1}[\frac{1}{s(s-2)^2}]$

---

3. a) Find the solution of the problem:

$$u_{tt} - c^2u_{xx} = x \quad , \quad -\infty < x < \infty$$
$$u(x,0) = \cos x \quad , \quad u_t(x,0) = 1 + x$$

b) Transform the problem:

$$u_{tt} - u_{xx} = \sin \pi x \quad \text{for} \quad 0 < x < 1$$
$$u(x,0) = u_t(x,0) = 0$$
$$u(0,t) = u_t(1,t) = 0 \quad , \quad 0 \le x \le t$$

To another problem with zero partial differential equation and then solve the problem.

---

4. a) Use the Laplace transform to solve the problem:

$$ty'' + 2y' + 4ty = 0 \ , \ y(0) = 1 \ , \ y'(0) = 0$$

b) Solve the problem:

$$u_{tt} = u_{xx} \quad \text{for} \ , \ 0 < x < \infty \ , \ 0 < t < \infty$$
$$u(x,0) = \cos x \ , \ u_t(x,0) = x \quad u(0,t) = 0$$

Good Luck