APMA 0350 – MIDTERM 1

Name	
Brown ID	
Signature	

1. *(5 points)* Solve the ODE and write your answer in explicit form

$$\begin{cases} t^2\,(y') - (2t)\,y = t^5\cos(t) & t > 0 \\ y(\pi) = 0 \end{cases}$$

$y =$	

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2. *(5 points)* Solve the ODE and write your answer in explicit form

$$\begin{cases} y' = \dfrac{\sin^{-1}(t)}{y\sqrt{1-t^2}} \\ y(0) = -2 \end{cases}$$

Note: $\left(\sin^{-1}(t)\right)' = \frac{1}{\sqrt{1-t^2}}$ and $\sin^{-1}(0) = 0$

$y =$

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3. *(5 points)* Solve the ODE, leave your answer in implicit form

$$\begin{cases} \left(\dfrac{\sin(y)}{y} - 2e^{-x}\sin(x)\right)dx + \left(\dfrac{\cos(y) + 2e^{-x}\cos(x)}{y}\right)dy = 0 \\ y(0) = \pi \end{cases}$$

Hint: Multiply your ODE by ye^x and <u>then</u> check for exactness

Answer	

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4. *(5 points)* Solve the ODE whose auxiliary equation is

$$-2(r+2)r^3(r-1)^4(r-2)\left(r^2-9r+20\right)^2\left(r^2+9\right)\left(r^2-4r+13\right)^2=0$$

Note: You do not need to write down the ODE

$y =$	

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5. *(5 points)* Let $h(t)$ be the height of a jumping bunny after t minutes, where $h(t)$ is in meters

   Thumper's law of motion states that the rate of change of the height is proportional to the reciprocal of height squared

   Initially, the height is 1 m and after 1 min the height is 4 m. What is the height at $t = 20$ seconds?

Height	

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(Scratch Paper)