MAT 2384-Practice Problems on Exact ODEs and Integrating Factors

For each of the following ODEs, test for exactness. If exact solve. If not, use an integrating factor to solve. If the ODE is equipped with an initial condition, use it to find the particular solution.

1. $(e^y - ye^x)dx + (xe^y - e^x)dy = 0$

2. $-\pi \sin(\pi x)\sinh(y)dx + \cos(\pi x)\cosh(y)dy = 0$

3. $9xdx + 4ydy = 0$

4. $e^{-2\theta}dr - 2re^{-2\theta}d\theta = 0$

5. $\left(-\frac{y}{x^2} + 2\cos(2x)\right)dx + \left(\frac{1}{x} - 2\sin(2y)\right)dy = 0$

6. $-2xy\sin(x^2)dx + \cos(x^2)dy = 0$

7. $-ydx + xdy = 0$

8. $(x^4 + y^2)dx - xydy = 0, \quad y(2) = 1$

9. $-y\sin(xy)dx - x\sin(xy)dy = 0, \quad y(1) = \pi$

10. $(\cos(2x) + 2\sin(2x))dx + e^x dy = 0, \quad y(0) = 1.$

11. $y\cos(x+y)dx + (3\sin(x+y) + y\cos(x+y))dy = 0, \quad y(0) = \frac{\pi}{2}$

12. $(\sin(y)\cos(y) + x\cos^2(y))dx + xdy = 0.$

13. Under what conditions on the Constants A, B, C and D is

$$(Ax + By)dx + (Cx + Dy)dy = 0$$

exact? Solve the exact equation.