King Fahd University of Petroleum and Minerals
Department of Mathematics

**Math 208**

**Exam 1**

**222**

**February 20, 2023**

**Net Time Allowed: 120 Minutes**

# USE THIS AS A TEMPLATE

**Write your questions, once you are satisfied upload this file.**

Q20/ P. 9 (Section 1.1)

1. If $y = ae^{-x} + bx - 1$ is a solution of the initial-value problem $y' = x - y,\ y(0) = 10$, then $a + b =$

   (a) 12
   (b) 11
   (c) 10
   (d) 13
   (e) 14

Q6/ P. 17 (Section 1.2)

2. If $y = y(x)$ is the solution of the initial-value problem

   $$\begin{array}{l} \dfrac{dy}{dx} = x\sqrt{x^2+9} \\ y(-4) = 0 \end{array}, \text{ then } y(4) =$$

   (a) 0
   (b) 1
   (c) $-1$
   (d) 2
   (e) $-2$

Example 4 / P. 36 (Section 1.4)

3. The seperable differential equation $\frac{dy}{dx} = 6x(y-1)^{2/3}$

(a) has $y = 1$ as a singular solution

(b) has $y = 1 + x^6$ as a singular solution

(c) has no singular solutions

(d) has $y = 1$ and $y = 1 + x^6$ as singular solutions

(e) has no solution

Q18 / P. 43 (Section 1.4)

4. If $y$ is the general solution of the differential equation $x^2y' = 1 - x^2 + y^2 - x^2y^2$, then there exists a constant $c$ such that

(a) $\tan^{-1} y + x + \frac{1}{x} = c$

(b) $\tan y + x + \frac{1}{x} = c$

(c) $\tan^{-1} y + x + 1 = c$

(d) $\cot^{-1} y + x + \frac{1}{x} = c$

(e) $\tan^{-1} y - x - \frac{1}{x} = c$

Q33 / P. 44 (Section 1.4)

5. A certain city had a population of $25,000$ in 1960 and a population of $50,000$ in 1970. Assume that population will continue to grow exponentially at a constant rate. What population can its city plans expect in the year 2000?

   (a) 400,000
   (b) 500,000
   (c) 300,000
   (d) 200,000
   (e) 600,000

Q19 / P. 56 (Section 1.5)

6. If $y$ is the general solution of the differential equation $y' + y\cot x = \cos x$, then there exists a constant $c$ such that

   (a) $y\sin x + \frac{1}{4}\cos 2x = c$
   (b) $y\sin x - \frac{1}{2}\cos 2x = c$
   (c) $y\cos x + \frac{1}{4}\sin 2x = c$
   (d) $y\cos x - \frac{1}{4}\sin 2x = c$
   (e) $y\sin x + \frac{1}{4}\sin 2x = c$

Q27 / P. 56 (Section 1.5)

7. If $y$ is the general solution of the differential equation $(x + ye^y)\dfrac{dy}{dx} = 1$, then there exists a constant $c$ such that $x =$

(a) $\frac{1}{2}e^y y^2 + ce^y$
(b) $e^y y^2 + ce^{-y}$
(c) $e^y y^2 + ce^y$
(d) $\frac{1}{2}e^y y^2 + ce^{-y}$
(e) $ce^{-y}$

Q39 / P. 74 (Section 1.6)

8. If the differential equation $(3x^2y^3 + y^4)\,dx + (kx^3y^2 + y^4 + 4xy^3)\,dy = 0$ is an exact differential equation, then $k =$

(a) 3
(b) 4
(c) 2
(d) 5
(e) 1

Q38/ P. 74 (Section 1.6)

9. If $y = y(x)$ is the general solution of the exact differential equation $(x + \tan^{-1} y)\, dx + \dfrac{x+y}{1+y^2}\, dy = 0$, then there exists a constant $c$ such that

(a) $\dfrac{x^2}{2} + x \tan^{-1} y + \dfrac{1}{2} \ln(1+y^2) = c$

(b) $x^2 + x \cot^{-1} y + \dfrac{1}{2} \ln(1+y^2) = c$

(c) $\dfrac{x^2}{2} + x \cot^{-1} y - \dfrac{1}{2} \ln(1+y^2) = c$

(d) $\dfrac{x^2}{2} + \tan^{-1} y + \dfrac{1}{2} \ln(1+y^2) = c$

(e) $\dfrac{x^2}{2} + x \tan^{-1} y - \dfrac{1}{2} \ln(1+y^2) = c$

Q24 / P. 155 (Section 3.1)

10. If $y(x) = A \cosh 3x + B \sinh 3x$ is a solution of the initial-value problem

$$y'' - 9y = 0$$
$$y(0) = 5$$
$$y'(0) = 12$$

then $A + B =$

(a) 9

(b) 10

(c) 11

(d) 8

(e) 7

Q19/ P. 155 (Section 3.1)

11. If we have the linear system

$$\begin{aligned} x - 2y + z &= 2 \\ 2x - y - 4z &= 13 \; , \\ x - y - z &= k \end{aligned}$$

then the system is inconsistent if $k \neq$

(a) 5
(b) 4
(c) 3
(d) 6
(e) 7

Q23/ P. 186 ( Section 3.4)

12. Let $A = \begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$. If $AB = I = BA$ where $I$ is the identity matrix, then $a + b + c + d =$

(a) 0
(b) 1
(c) $-1$
(d) 2
(e) $-2$

Example 11 / P. 214 (Section 3.6)

13. Let $A = \begin{bmatrix} 1 & 4 & 5 \\ 4 & 2 & 5 \\ -3 & 3 & -1 \end{bmatrix}$. If $\text{adj}A = \begin{bmatrix} c & 19 & 10 \\ -11 & a & d \\ * & b & -14 \end{bmatrix}$, then $a + b + c + d =$

(a) $-3$
(b) $-4$
(c) $-2$
(d) $-5$
(e) $-1$

Example 1 / P. 168 (Section 3.3)

14. Which of the following matrices are in a reduced echelon matrix form?

(a) $\begin{bmatrix} 1 & 0 & -3 & 0 \\ 0 & 1 & 4 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$

(b) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

(c) $\begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

(d) $\begin{bmatrix} 1 & -2 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

(e) $\begin{bmatrix} 0 & 1 & 5 \\ 1 & 0 & -7 \\ 0 & 0 & 0 \end{bmatrix}$