

Do not remove this answer page — you will turn in the entire exam. You have two hours to do this exam. No books or notes may be used. You may use a graphing calculator during the exam, but NO calculator with a Computer Algebra System (CAS) or a QWERTY keyboard is permitted. Absolutely no cell phone use during the exam is allowed.

Part I consists of 12 multiple choice questions worth 5 points each. Record your answers on this page by filling in the box corresponding to the correct answer. For example, if (b) is correct, you must write

a b c d e

Do not circle answers on this page, but please do circle the letter of each correct response in the body of the exam. It is your responsibility to make it CLEAR which response has been chosen. You will not get credit unless the correct answer has been marked on both this page and in the body of the exam.

Part II consists of 4 partial credit problems worth a total of 40 points. Write your answer and show ALL your work on the page on which the question appears.

GOOD LUCK!

1. a b c d e

7. a b c d e

2. a b c d e

8. a b c d e

3. a b c d e

9. a b c d e

4. a b c d e

10. a b c d e

5. a b c d e

11. a b c d e

6. a b c d e

12. a b c d e

For grading use:

Question	Score	Total
1-12		60
13		10
14		10
15		10
16		10
Total	(out of 100 pts)	100

Please make sure to list the correct section number on the front page of your exam.
In case you forgot your section number, consult the following table:

Section #	Instructor	Lectures
002	W. Guo	MWF 9:00am-9:50am, BE 213
003	G. Butcher	MWF 10:00am-10:50am, CB 337
004	A. Bagchi Misra	MWF 10:00am-10:50am, FB 213
005	G. Butcher	MWF 11:00am-11:50am, CB 335
006	A. Corso	MWF 12:00pm-12:50pm, CB 114
008	W. Guo	MWF 1:00pm-1:50pm, CB 335
009	L. Roberson	MWF 2:00pm-2:50pm, CB 337
010	A. Bagchi Misra	MWF 3:00pm-3:50pm, CB 335
011	L. Roberson	MWF 3:00pm-3:50pm, CB 337
013	S. Nanwani	TR 8:00am-9:15am, CB 335
019	P. Zhang	TR 12:30pm-1:45pm, BS 108
020	S. Nanwani	TR 2:00pm-3:15pm, CB 333
021	Y. Li	TR 2:00pm-3:15pm, CB 347
022	Y. Li	TR 3:30pm-4:45pm, CB 335
023	P. Zhang	TR 3:30pm-4:45pm, CB 339
401	C. Norman	TR 6:00pm-7:15pm, CP 201
403	E. Stokes	TR 6:00pm-7:15pm, CB 337
404	E. Stokes	TR 7:30pm-8:45pm, CB 337

PART I

Multiple Choice Questions (5 points each)

Show all your work on the page where the question appears.
Clearly mark your answer both on the cover page on this exam
and in the corresponding questions that follow.

1. If we solve the inequality

$$x^2 + 3x - 4 \leq 0$$

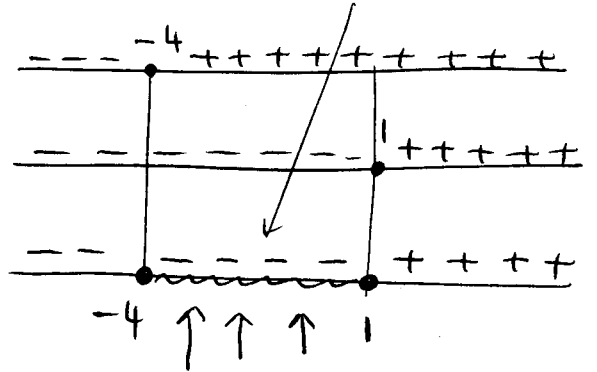
then x lies in the interval(s):

$$(x + 4)(x - 1) \leq 0$$

$$x + 4$$

$$x - 1$$

$$(x + 4)(x - 1)$$



$$\therefore -4 \leq x \leq 1$$

Possibilities:

- (a) $-1 \leq x \leq 4$
- (b) $x \leq -4, x \geq 1$
- (c) $-4 \leq x \leq 1$
- (d) $x \leq -1, x \geq 4$
- (e) $-3 < x < 4$



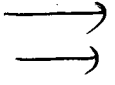
2. If we solve the inequality

$$\left| \frac{x}{3} - \frac{1}{2} \right| \leq 1$$

then x lies in the interval(s):

Possibilities:

- (a) $-\frac{3}{2} \leq x \leq \frac{9}{2}$
- (b) $x \leq -\frac{3}{2}, x \geq \frac{9}{2}$
- (c) $x \leq \frac{9}{2}$
- (d) $-\frac{1}{6} \leq x \leq \frac{1}{2}$
- (e) $x \leq -\frac{1}{6}, x \geq \frac{1}{2}$



$$\begin{aligned} -1 &\leq \frac{x}{3} - \frac{1}{2} \leq 1 \\ \frac{1}{2} - 1 &\leq \frac{x}{3} \leq 1 + \frac{1}{2} \\ -\frac{1}{2} &\leq \frac{x}{3} \leq \frac{3}{2} \\ -\frac{3}{2} &\leq x \leq \frac{9}{2} \end{aligned}$$

3. The solution(s) of the equation

$$\sqrt{x-2} = x-8$$

is (are):

$$x-2 = (x-8)^2$$

$$x-2 = x^2 - 16x + 64$$

$$x^2 - 17x + 66 = 0$$

$$(x-11)(x-6) = 0$$

Possibilities:

(a) $x = -11$

(b) $x = 6, x = 11$

(c) $x = -11, x = -6$

⇒ (d) $x = 11$

(e) $x = 6$

$x = 11$

and

~~$x = 6$~~

does not satisfy the equation.

4. The only solution of the equation

$$3x + 2\sqrt{x} - 1 = 0$$

is:

set $u = \sqrt{x}$ so $u^2 = x$ thus after the substitution we get:

$$3u^2 + 2u - 1 = 0$$

$$(3u-1)(u+1) = 0$$

Possibilities:

(a) $x = -1$

⇒ (b) $x = \frac{1}{9}$

(c) $x = -\frac{1}{9}$

(d) $x = -\frac{1}{3}$

(e) $x = \frac{1}{3}$

∴ $u = \frac{1}{3}$

and $u = -1$

∴ $x = \frac{1}{9}$

and ~~$x = 1$~~

not a solution

5. If $A(2, -3)$ and $B(1, 4)$ are the endpoints of a diameter of a circle, then the center C of the circle is given by:

$C = \text{midpoint of } A \text{ and } B$

$$x_c = \frac{2+1}{2}, \quad y_c = \frac{-3+4}{2}$$

$$\therefore \boxed{C \left(\frac{3}{2}, \frac{1}{2} \right)}$$

Possibilities:

(a) $C \left(-\frac{1}{2}, \frac{7}{2} \right)$

(b) $C(3, 1)$

(c) $C(-1, 7)$

(d) $C(1, -7)$

\rightarrow \rightarrow $\boxed{\text{(e) } C \left(\frac{3}{2}, \frac{1}{2} \right)}$

6. Which of the following points lies on the graph of $x^2 + 2xy = 6$?

plug in the various values -
only (d) will satisfy
the equation.

Possibilities:

(a) $\left(2, -\frac{1}{2} \right)$

(b) $(3, 0)$

(c) $(0, -1)$

\rightarrow \rightarrow $\boxed{\text{(d) } \left(6, -\frac{5}{2} \right)}$

(e) $(5, 1)$

$$6^2 + 2 \cdot 6 \left(-\frac{5}{2} \right) \stackrel{?}{=} 6$$

$$36 - 30 \stackrel{?}{=} 6$$

YES

7. Which of the following is an equation of the circle with radius $r = 3$ and centered at $C(1, -2)$?

$$(x-1)^2 + (y - (-2))^2 = 3^2$$
$$(x-1)^2 + (y+2)^2 = 9$$

Possibilities:

(a) $(x+1)^2 + (y+2)^2 = 3$

(b) $(x+1)^2 + (y-2)^2 = 9$

(c) $(x-1)^2 + (y+2)^2 = 3$

→ (d) $(x-1)^2 + (y+2)^2 = 9$

(e) $(x+1)^2 + (y-2)^2 = 3$

8. The distance between the points $P(5, 3)$ and $Q(-2, -1)$ is:

$$\text{dist}(P, Q) = \sqrt{(5 - (-2))^2 + (3 - (-1))^2}$$
$$= \sqrt{7^2 + 4^2}$$
$$= \sqrt{49 + 16}$$
$$= \sqrt{65}$$

Possibilities:

(a) $\sqrt{13}$

(b) $\sqrt{11}$

→ (c) $\sqrt{65}$

(d) $\sqrt{5}$

(e) $\frac{3 - (-1)}{5 - (-2)}$

9. The equation of the line through the points $P(-2, 3)$ and $Q(2, 11)$ is given by:

$$\text{slope} = \frac{11 - 3}{2 - (-2)} = \frac{8}{4} = 2$$

$$\therefore y - 11 = 2(x - 2)$$

$$y = 2x - 4 + 11$$

$$y = 2x + 7$$

Possibilities:

- (a) $y = 2x + 7$
 (b) $2x - y = -11$
 (c) $y - 3 = -2(x + 2)$
 (d) $y + 2 = 2(x - 3)$
 (e) $y - 11 = -2(x - 2)$

10. The equation of the line through the point $P(-3, 2)$ and perpendicular to the line $4x - 3y - 7 = 0$ is given by:

perpendicular line has slope $m' = -3/4$

$$3y = 4x - 7$$

$$y = \frac{4}{3}x - \frac{7}{3}$$

slope $m = 4/3$

$$\therefore y - 2 = -\frac{3}{4}(x - (-3))$$

$$4(y - 2) = -3(x + 3)$$

$$4y - 8 = -3x - 9$$

$$3x + 4y + 1 = 0$$

Possibilities:

- (a) $y + 2 = -\frac{3}{4}(x - 3)$
 (b) $4x - 3y - 18 = 0$
 (c) $3x + 4y + 1 = 0$
 (d) $3x + 4y - 1 = 0$
 (e) $4x - 3y + 18 = 0$

11. The solution of the system of linear equations

$$\begin{cases} x + y = 3 \\ 3x + 2y = 1 \end{cases}$$

is given by:

$$-2 \begin{cases} x + y = 3 \\ 3x + 2y = 1 \end{cases}$$

Possibilities:

(a) $x = 5$ and $y = -8$

⇒ (b) $x = -5$ and $y = 8$

(c) $x = 3$ and $y = 0$

(d) $x = 1$ and $y = 2$

(e) $x = 1$ and $y = -1$

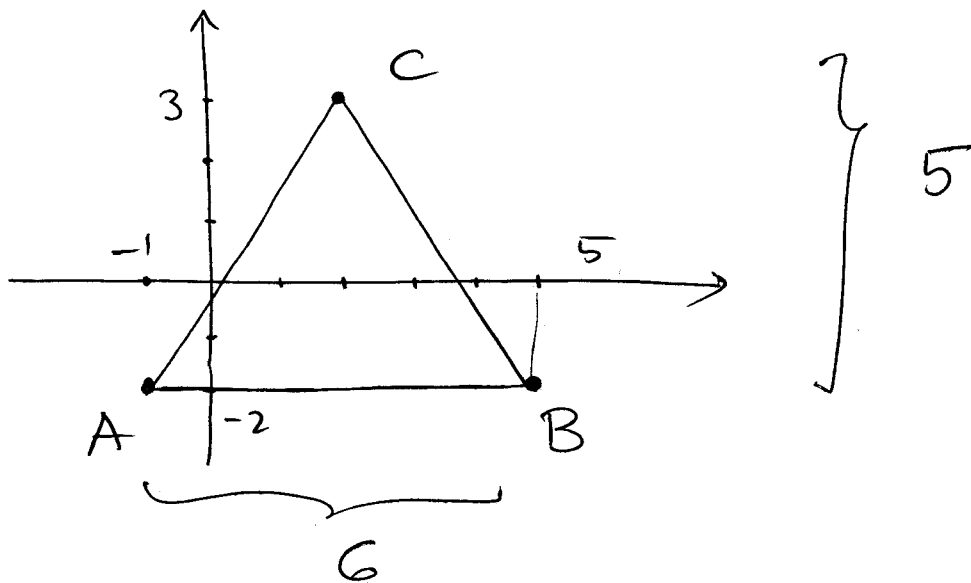
$$\begin{cases} -2x - 2y = -6 \\ 3x + 2y = 1 \end{cases}$$

$$x + 0 = -5$$

∴ $x = -5$

$y = 3 - x$ ∴ $y = 3 - (-5)$
 $y = 8$

12. The area of the triangle with vertices $A(-1, -2)$, $B(5, -2)$ and $C(2, 3)$ is:



Possibilities:

(a) area = 30

(b) area = 6

(c) area = 8

(d) area = 16

⇒ (e) area = 15

$$\text{Area} = \frac{6 \cdot 5}{2} = 15$$

PART II

Partial Credit Questions (10 points each)

Show all your work and put your final answer in the space provided.

Use the backs of the test sheets if you need more workspace.

No credit will be given for a correct answer without showing how it was obtained.

You will receive no credit if the answer is not in the space provided and

no partial credit for a wrong answer if you do not show your work.

13. (a) (5 pts) Find the solutions of the equation

$$6 - |2x + 7| = 3.$$

$$6 - 3 = |2x + 7|$$

$$|2x + 7| = 3$$

$$2x + 7 = \pm 3$$

$$2x + 7 = 3$$

$$2x = -4$$

$$x = -2$$

$$2x + 7 = -3$$

$$2x = -10$$

$$x = -5$$

Answer: _____

(b) (5 pts) Find the center and the radius of the circle whose equation is given by

$$x^2 + y^2 - 6x + 4y - 12 = 0.$$

$$[x^2 - 6x] + [y^2 + 4y] = 12$$

$$[x^2 - 6x + \underline{\underline{9}}] + [y^2 + 4y + \underline{\underline{4}}] = 12 + 9 + 4$$

$$(x - 3)^2 + (y + 2)^2 = 25$$

$$C(3, -2) \quad r = 5$$

Answer: _____

pts: /10

14. A ball is thrown straight upward at an initial speed of 96 feet per seconds. From Physics, it is known that, after t seconds, the ball reaches a height of h feet given by the formula:

$$h = -16t^2 + 96t.$$

- (a) (5 pts) At what time t ($t > 0$) does the object return to ground?

$$h = \boxed{-16t^2 + 96t = 0}$$

$$-16t(t - 6) = 0$$

$$\therefore t = 0 \quad \text{or} \quad \boxed{t = 6} \text{ seconds}$$

Answer: _____

- (b) (5 pts) At what time(s) does the ball attain a height of 80 feet?

$$h = -16[t^2 - 6t]$$

Complete square

$$= -16[t^2 - 6t + 9] + 16 \cdot 9$$

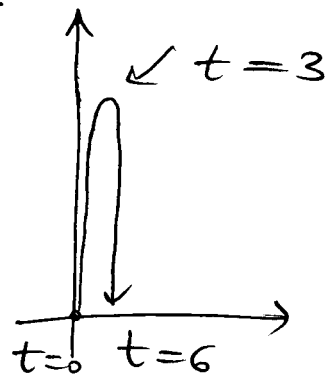
$$= -16[t - 3]^2 + 144$$

the max is attained when $t = 3$

Answer: _____

$t = 3$ seconds

pts: /10



15. (a) (5 pts) Write an equation of the line through the points $P(1, 8)$ and $Q(12, 4)$.

$$\text{slope } : \quad \frac{8-4}{1-12} = -\frac{4}{11}$$

$$y - 8 = -\frac{4}{11}(x - 1)$$

$$\text{or } \quad 11(y - 8) = -4(x - 1)$$

$$11y - 88 = -4x + 4$$

$$4x + 11y - 92 = 0$$

Answer: _____

- (b) (5 pts) Write an equation of the line through the point $P(5, 2)$ and parallel to the line $4x - 3y = 11$.

$$3y = 4x - 11$$

$$y = \frac{4}{3}x - \frac{11}{3}$$

$$\text{slope } m = \frac{4}{3}$$

the parallel line has slope $m' = \frac{4}{3}$

$$y - 2 = \frac{4}{3}(x - 5)$$

$$\text{or } \quad 3(y - 2) = 4(x - 5)$$

$$3y - 6 = 4x - 20$$

$$4x - 3y - 14 = 0$$

Answer: _____

pts: /10

16. (a) (5 pts) Find all solutions of the system of equations:

$$\begin{cases} 3x + y = 10 \\ 7x + 2y = 1. \end{cases}$$

$$-2 \begin{cases} 3x + y = 10 \\ 7x + 2y = 1 \end{cases}$$

$$\begin{cases} -6x - 2y = -20 \\ 7x + 2y = 1 \end{cases}$$

$$x + 0 = -19$$

$$x = -19$$

$$\begin{cases} x = -19 \\ y = -3x + 10 \end{cases}$$

$$y = -3(-19) + 10$$

$$= +67$$

$$\therefore \boxed{P(-19, 67)}$$

Answer: _____

(b) (5 pts) The graphs of the following two equations intersect at two points. Find these two points by solving the system:

$$\begin{cases} -x + y = 4 \\ xy = 12. \end{cases}$$

$$\begin{cases} y = x + 4 \\ xy = 12 \end{cases}$$

$$x(x + 4) = 12$$

$$x^2 + 4x - 12 = 0$$

$$(x + 6)(x - 2) = 0$$

$$x = -6 \quad \text{or} \quad x = +2$$

$$\begin{cases} x = -6 \\ y = x + 4 \\ \therefore y = -2 \end{cases}$$

or

$$\begin{cases} x = +2 \\ y = x + 4 \\ \therefore y = 6 \end{cases}$$

Answer: _____

$$(-6, -2) \quad \text{or} \quad (2, 6)$$

pts: /10