Directions:

- This is a two hour exam. Clearly print your name on the first page and the top of the third page (second piece of paper). No books, notes, internet connection, or cell phone can be used during this exam. Any scratch paper must be provided to you by the proctor and turned in with the exam. A calculator maybe used; however, the calculator cannot have a Computer Algebra System (CAS) or a QWERTY keyboard. When you have completed the exam:
  1) Turn in the entire exam (including cover page, and any scratch papers) to the proctor
  2) Show your ID to the proctor
  3) Sign the "Sign Out Sheet"
- All answers must be fully filled in on the front page, like so:

  (A) B C D E
- The exam is out of 100 total points; however, it is possible to earn up to 120 points (5 points for each of the 24 questions). Only this front page will be graded and no partial credit will be awarded. Consequently, please double check to make sure that you have marked the answer you desire. Good Luck!

#1 B	#9 E	#17 D
#2 C	#10 A	#18 A
#3 D	#11 B	#19 E
#4 E	#12 C	#20 D
#5 D	#13 A	#21 A
#6 C	#14 B	#22 A
#7 D	#15 B	#23 D
#8 A	#16 D	#24 C

Name (Print): Key

Section Number: _____

Section	Instructor	Class Start Time	Exam Location
001	Drew Butcher	MWF 8:00 AM	BS 116
002	Drew Butcher	MWF 10:00 AM	BS 107
003	Drew Butcher	MWF 1:00 PM	CB 118
004	Robert Wolf	MWF 9:00 AM	CB 122
005	Robert Wolf	MWF 11:00 AM	CB 122
006	Ian Barnett	TR 11:00 AM	CB 114
007	Ian Barnett	TR 12:30 PM	CB 114
008	Devin Willmott	TR 2:00 PM	CB 110
009	Devin Willmott	TR 3:30 PM	CB 110

UK: "Go CATS" Name: Key Section:_____

1. (5 points) Which of the following do we get if we solve $3x^2 + y = x$ for y and substitute the result into $x + y = 1$?

$-3x^2 \quad -3x^2$

$y = x - 3x^2$

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

$2x - 3x^2 = 1$

   A. $2x + 3x^2 = 1$
   B. $2x - 3x^2 = 1$
   C. $-3x^2 = 1$
   D. $3x^2 = 1$
   E. None of the above

2. (5 points) Which of the following is a solution to the system of equations

$$\begin{aligned} x - y &= 4 \\ x + y &= 1 \end{aligned}$$

$2x = 5$

$x = \frac{5}{2}$

$\frac{5}{2} + y = 1$

$y = \frac{2}{2} - \frac{5}{2} = \frac{-3}{2}$

   A. $(0, -4)$ and $(4, 0)$
   B. $(4, 0)$
   C. $\left(\frac{5}{2}, -\frac{3}{2}\right)$
   D. $\left(\frac{5}{2}, -\frac{3}{2}\right)$ and $(0, 4)$
   E. None of the above

3. (5 points) Find all solutions to the following system of equations:

note $y \neq 0$

$$\begin{aligned} \frac{x}{y} &= 2 \quad \text{mult. by } y \\ x - y &= 0 \end{aligned}$$

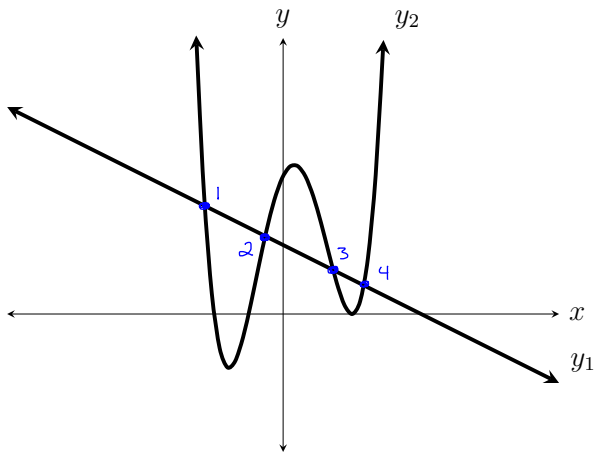
$x = 2y$

$2y - y = 0$

$y = 0$ ∴ since $y \neq 0$ we have no solution

   A. $(0, 0)$
   B. $(1, 1)$
   C. $(0, 0)$ and $(1, 1)$
   D. None; the system is inconsistent
   E. Infinitely many; the system is dependent

4. (5 points) The graph of two equations are shown below. Determine the number of solutions for this system of equations.



A. 0
B. 1
C. 2
D. 3
E. 4

5. (5 points) How many solutions does the following system of equations have?

$$x^3 + y^2 = 4$$
$$x^2 + y^2 = 4$$

$x^3 + y^2 = 4$
$-x^2 - y^2 = -4$ ($\times(-1)$)
$x^3 - x^2 = 0$
$x^2(x-1) = 0$

$x^2 = 0$ or $x - 1 = 0$
$x = 0$ $x = 1$

A. 0
B. 1
C. 2
D. 4
E. Infinitely many

$0^2 + y^2 = 4$
$y = \pm\sqrt{4}$
$y = \pm 2$
$(0,2)$, $(0,-2)$
1 2

$1^2 + y^2 = 4$
$1 + y^2 = 4$
$y^2 = 3$
$y = \pm\sqrt{3}$
$(1,\sqrt{3})$, $(1,-\sqrt{3})$
3 4

4 solutions

6. (5 points) Which of the following is always true about a dependent system of equations with two equations?

   A. There are no solutions to the system of equations

   B. There is exactly one solution to the system of equations

   C. There are infinitely many solutions to the system of equations

   D. The system is linear

   E. The graphs of the equations never intersect

7. (5 points) Solve the following system of equations.

$$x + 2y = 13 \quad \rightarrow \quad x = 13 - 2y$$
$$7x - y = 31$$

$7(13-2y) - y = 31$

$91 - 14y - y = 31$

$91 - 15y = 31$

$-91 \quad -91$

$\frac{-15y}{-15} = \frac{-60}{-15}$

$x = 13 - 2(4)$

$x = 13 - 8$

$x = 5$

$(5, 4)$

   A. $x = 3$, $y = 8$

   B. $x = 5$, $y = 8$

   C. $x = \frac{18}{13}$, $y = -\frac{5}{26}$

   D. $x = 5$, $y = 4$

   E. $x = 3$, $y = 4$

8. (5 points) Solve the following system of equations.

$y = 4$

$$4x + 6y = 20 \quad \xrightarrow{\times 3} \quad 12x + 18y = 60$$
$$6x + 9y = 15 \quad \xrightarrow{\times(-2)} \quad -12x - 18y = -30$$

$0x + 0y = 30$

$0 = 30$ ∴

No solution

   A. The system has no solution

   B. $x = 2$, $y = 2$

   C. $x = 1$, $y = 1$

   D. $x = 1$, $y = 2$

   E. $x = 2$, $y = 1$

9. (5 points) Which of the following viewing windows best depicts the graph of the equation

$$y = x^4 + 4x^3 - x^2 - 5x + 1$$

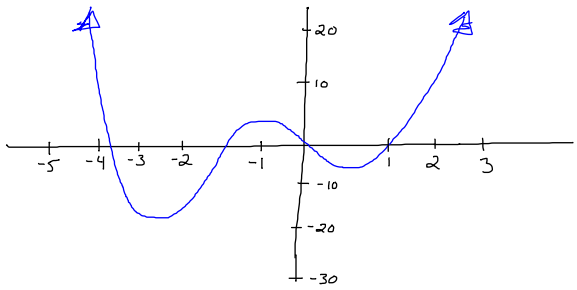
   A. $-5 \leq x \leq -2$; $-30 \leq y \leq 20$

   B. $-1 \leq x \leq 3$; $-10 \leq y \leq 20$

   C. $-2 \leq x \leq 3$; $-10 \leq y \leq 10$

   D. $-5 \leq x \leq 3$; $-30 \leq y \leq 20$

   E. $2 \leq x \leq 3$; $-5 \leq y \leq 50$



10. (5 points) Determine which of the below graphs represents the equation

$$y^2 + x = 4$$

$y^2 = 4 - x$

$y = \pm\sqrt{4-x}$

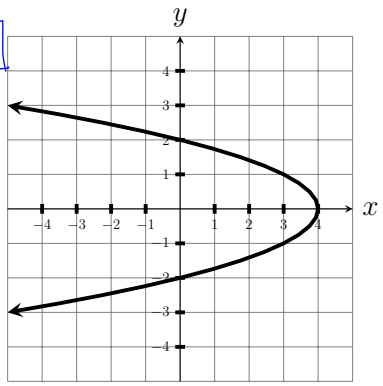
Graph

$y_1 = \sqrt{4-x}$

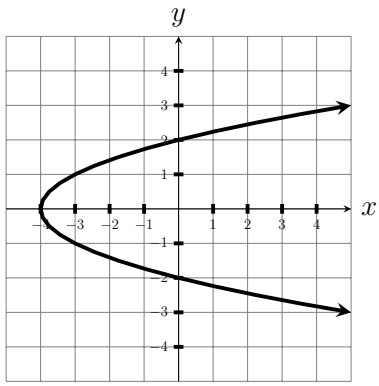
$y_2 = -\sqrt{4-x}$

by graphing the equation in a square viewing window.

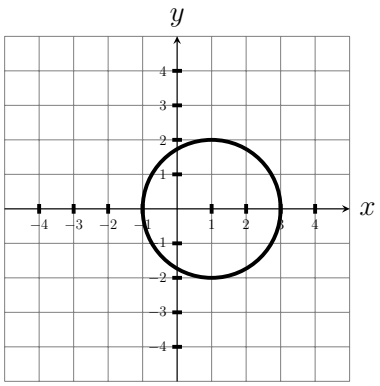
A.



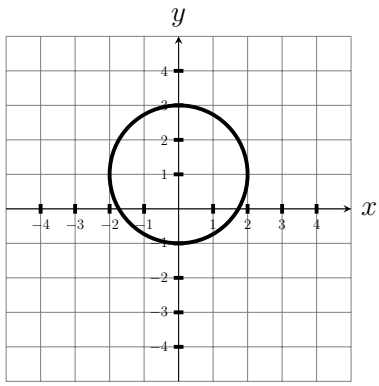
B.



C.



D.



E. None of the above

11. (5 points) Using a graphing utility determine the number of solution(s) to the equation

$$3x^4 + 20x = 5x^3 + 9x^2 + 5$$

2 points of intersection = 2 solutions

(**Hint**: one need not solve the above equation).

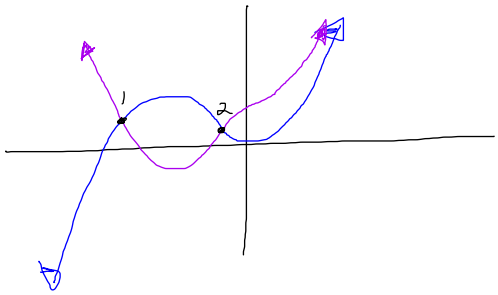
A. 1 solution

B. 2 solutions

C. 3 solutions

D. 4 solutions

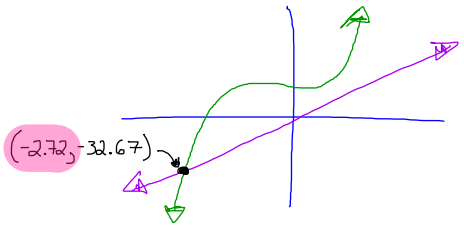
E. None of the above



12. (5 points) Using a graphing utility determine which of the following is an approximate solution (rounded to two decimal places) to the equation

$$12x = 4x^3 + 5x^2 + 11$$

on the interval $(-\infty, 0)$.



A. $(-2.72, -32.67)$

B. $(-32.67, -2.72)$

C. $x \approx -2.72$

D. $x \approx -32.67$

E. None of the above

13. (5 points) After receiving an 8% pay raise your new paycheck is now \$2,000 per month. Letting "x" denote your monthly pay check before the raise, which of the following equations represents an algebraic equation for this situation?

A. $x + 0.08x = 2000$

Original pay + raise = New pay

$x + 0.08x = 2000$

B. $x - 0.08x = 2000$

C. $x = 2000 - 0.08$

D. $x = 2000 + 0.08$

E. None of the above

14. (5 points) You invest \$50,000 into two separate accounts. The first account earns interest at 5% while the second account earns interest at 29%. How much should be invested in the account earning 29% interest so that the total return is 8% on your entire \$50,000 investment.

A. \$43,750

B. \$6,250

C. \$25,000

D. \$14,500

E. None of the above

x = amount invested @ 5%
y = amount invested @ 29%

$x + y = 50{,}000 \xrightarrow{-0.05} -0.05x - 0.05y = -2500$

$0.05x + 0.29y = 4{,}000 \longrightarrow 0.05x + 0.29y = 4000$

$\frac{0.24y}{0.24} = \frac{1500}{0.24}$

$y = 6{,}250$

15. (5 points) A radiator contains 17 liters of fluid, 15% of which is antifreeze. The mechanic drains part of the radiator and replaces the drained amount with pure antifreeze so that the new mixture is 25% antifreeze. Determine the amount of fluid that the mechanic must drain from the radiator.

A. 1.7 liters

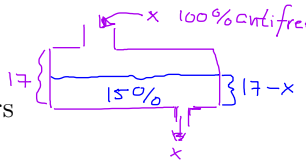
B. 2 liters

C. 2.55 liters

D. 8.5 liters

E. None of the above

Let x be the amount of liquid (liters) drained from the radiator



Amount of antifreeze after draining + New Antifreeze added = Total amount of Antifreeze

$(17 - x)(0.15) + x = 17(0.25)$

$2.55 - 0.15x + x = 4.25$

$2.55 + 0.85x = 4.25$

$-2.55 \quad -2.55$

$\frac{0.85x}{0.85} = \frac{1.7}{0.85}$

$x = 2$ liters

16. (5 points) A rectangle has area 85 square inches and perimeter 44 inches. Letting "l" be the length of the rectangle and "w" be the width of the rectangle, determine which of the following system of equations mathematically represents this situation.

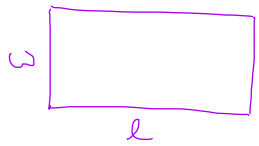
A. $\begin{cases} l+w &= 85 \\ lw &= 44 \end{cases}$

B. $\begin{cases} l+w &= 44 \\ lw &= 85 \end{cases}$

C. $\begin{cases} 2l+2w &= 85 \\ lw &= 44 \end{cases}$

D. $\begin{cases} 2l+2w &= 44 \\ lw &= 85 \end{cases}$

E. None of the above



Perimeter $= 2l+2w$
area $= l \cdot w$

17. (5 points) A farmer is building a three sided rectangular fence against his house for a garden. He uses 50 feet of fencing and wants to enclose 200 square feet. The farmer needs to know what will be the length, l, and width, w, of the fence. If no fence is needed along the side of the house, which of the following equations is relevant to the problem?

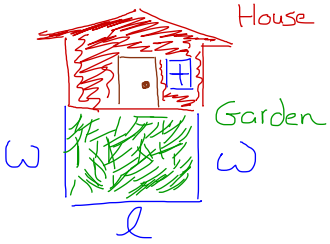
A. $wl = 50$

B. $2w + 2l = 50$

C. $wl^2 = 200$

D. $2w + l = 50$

E. $2w + 2l = 200$



Peremeter:
$l + 2w = 50$
Area:
$lw = 200$

18. (5 points) A chef is adjusting the acidity of his vinegar. He starts with 100 ml of vinegar that is 4% acetic acid. How much vinegar with 6% acetic acid does he need to add to get a bottle that is 5% acetic acid.

Which of the following equations is relevant to the above problem?

A. $100 * (0.04) + x * (0.06) = (x + 100) * (0.05)$

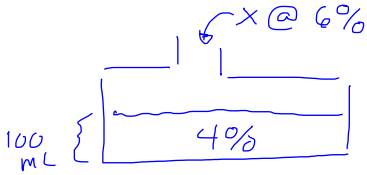
B. $100 * (0.06) + x * (0.05) = (x + 100) * (0.04)$

C. $100 + x = 200$

D. $\dfrac{100}{0.06} + \dfrac{x}{0.05} = \dfrac{x+100}{0.04}$

E. $\dfrac{100}{0.04} + \dfrac{x}{0.06} = \dfrac{x+100}{0.05}$

Let x be the amount of vinegar with 6% acetic acid added



Amount of acid before adding + Amount of acid added = Total Amount of acid

$100(0.04) + x(0.06) = (100+x)(0.05)$

19. (5 points) Suppose you have a square with side length 10. You want to increase the length of the sides of the square so that the area is increased by 50. If s is the final length of a side, then which of the following equations is relevant to the problem?

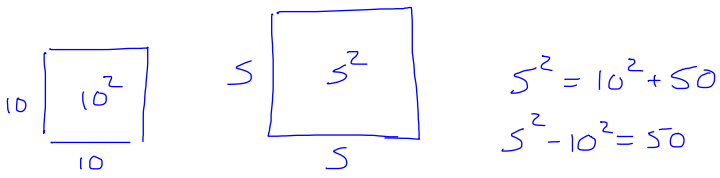
A. $s^2 = 100$

B. $4s = 50$

C. $4s - 10 = 50$

D. $(s+10)^2 = 150$

E. $s^2 - 10^2 = 50$



20. (5 points) A 12 ft ladder is leaning against the side of a house. The top of the ladder is 5 feet above the ground. Suppose we slide the base of the ladder closer to the wall until it is x feet away from the wall. This causes the top of the ladder to slide exactly 1 foot up the wall. Which of the following equations is relevant to this problem?

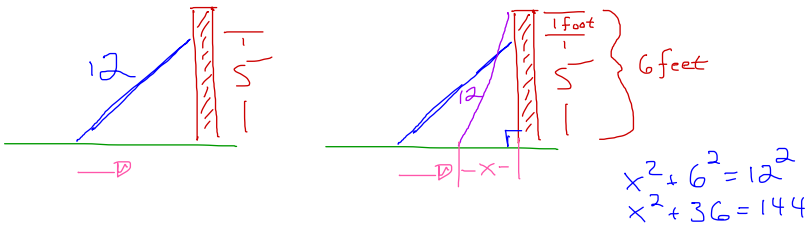
A. $5 + x = 12$

B. $6 + x = 12$

C. $36 + x^2 = 144$

D. $36 - 25 = x^2$

E. $36 - 25 = (x+1)^2$



21. (5 points) Solve the following inequality and express your answer in interval notation

$$(x-1)(x-2)(x-3) < 0$$

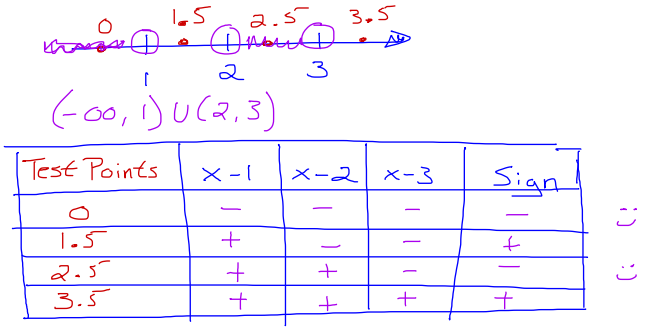
A. $(-\infty, 1) \cup (2, 3)$

B. $(1, 2) \cup (3, \infty)$

C. $(-\infty, 1)$

D. $[1, 2] \cup [3, \infty)$

E. None of the above



22. (5 points) Solve the following inequality and express your answer in interval notation

$$|2x+3|<5$$

If $|w|<5$ then

$-5<w<5$

$-5<2x+3<5$

$-5-3<2x+3-3<5-3$

$-8<2x<2$

$\frac{-8}{2}<\frac{2x}{2}<\frac{2}{2}$

$-4<x<1$

$(-4,1)$

A. $(-4,1)$

B. $[-4,1]$

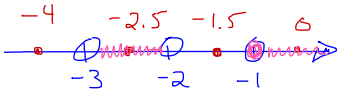
C. $(-\infty,1)$

D. $(-\infty,1]$

E. None of the above

23. (5 points) Solve the following inequality and express your answer in interval notation

$$\frac{x+1}{(x+2)(x+3)}\geq 0$$



Test Points	x+1	x+2	x+3	sign
-4	−	−	−	−
-2.5	−	−	+	+
-1.5	−	+	+	−
0	+	+	+	+

$(-3,-2)\cup[-1,\infty)$

A. $(-3,-2)$

B. $(-3,-2)\cup(-1,\infty)$

C. $(-3,-2)\cup[1,5)$

D. $(-3,-2)\cup[-1,\infty)$

E. None of the above

24. (5 points) Which of the following equations corresponds to the sentence "The distance from 3 to x is more than 7"?

A. $|7-x|>3$

B. $|3-x|\geq 7$

C. $|x-3|>7$

D. $|7-x|\geq 3$

E. None of the above