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 (5 points for each of the 20 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 A B C **D** E
#2 A **B** C D E
#3 A B **C** D E
#4 A B C **D** E
#5 **A** B C D E
#6 A B **C** D E
#7 A B **C** D E
#8 **A** B C D E
#9 **A** B C D E
#10 A B C **D** E

#11 A **B** C D E
#12 A B **C** D E
#13 A B C D **E**
#14 A **B** C D E
#15 **A** B C D E
#16 A **B** C D E
#17 A B **C** D E
#18 A B **C** D E
#19 **A** B C D E
#20 A B C **D** E

Name (Print):_____

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:_____ Section:_____

1. (5 points) Determine the order of operations being applied to x in the expression

$$\pi + 3\left(\sqrt{2} + x^2\right)$$

What is the 2nd operation?

A. Adding π
B. Squaring
C. Multiplying by 3
D. Adding $\sqrt{2}$
E. None of the above

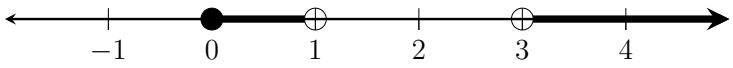
1st Square $x \rightsquigarrow x^2$
2nd Add $\sqrt{2}$ $x^2 \rightsquigarrow x^2 + \sqrt{2} = \sqrt{2} + x^2$
3rd Multiply by 3 $\sqrt{2} + x^2 \rightsquigarrow 3(\sqrt{2} + x^2)$
4th Add π $3(\sqrt{2} + x) \rightsquigarrow 3(\sqrt{2} + x^2) + \pi$
$= \pi + 3(\sqrt{2} + x^2)$

2. (5 points) Find the **exact** value of

$$-\left(3 - \sqrt{5}\right) = -1 \cdot (3 - \sqrt{5})$$
$$= -3 + \sqrt{5}$$
$$= \sqrt{5} + (-3)$$
$$= \sqrt{5} - 3$$

A. $3 - \sqrt{5}$
B. $\sqrt{5} - 3$
C. $-3 - \sqrt{5}$
D. -0.7639
E. None of the above

3. (5 points) Which interval represents the number line below?



A. $(0, 1] \cup [3, \infty]$
B. $(-\infty, 0] \cup (1, 3)$
C. $[0, 1) \cup (3, \infty)$
D. $[-\infty, 0) \cup [1, 3]$
E. None of the above.

$[0, 1) \cup (3, \infty)$

4. (5 points) Find the distance between 17 and -1.

A. 16
B. -16
C. -18
D. 18
E. 17

$|17 - (-1)| = |17 + 1| = |18| = 18$

5. (5 points) Consider the equation $\frac{1}{y+1} - 1 = 1$. Solve for y.

A. $y = -\frac{1}{2}$

B. $y = 1$

C. $y = 0$

D. $y = -1$

E. There are no solutions.

6. (5 points) Find all real solutions to the equation $(x-2)^4 = 16$.

A. $x = -\sqrt{2}$ and $x = \sqrt{2}$

B. $x = 2 - \sqrt{2}$ and $x = 2 + \sqrt{2}$

C. $x = 0$ and $x = 4$

D. $x = -\sqrt[4]{40}$ and $x = \sqrt[4]{40}$

E. None of the above

7. (5 points) Solve the equation $\frac{s-1}{q} = \frac{1+s}{p}$ for s.

A. $s = \frac{1+q}{p-q}$

B. $s = \frac{p+q}{1-q}$

C. $s = \frac{p+q}{p-q}$

D. $s = \frac{1+q}{p-q}$

E. No Solution

8. (5 points) Find all solutions to the equation $5x^3 - 55 = 0$.

A. $x = \sqrt[3]{11}$

B. $x = \sqrt[3]{5}$ and $x = \sqrt[3]{11}$

C. $x = -\sqrt[3]{11}$

D. $x = \sqrt[3]{11}$ and $x = -\sqrt[3]{11}$

E. $x = \sqrt[3]{5}$

9. (5 points) Which equation represents the statement, "the distance on the number line from x to -8 is 2"?

   A. $|x+8|=2$
   B. $|x-2|=8$
   C. $|x-8|=2$
   D. $|x+2|=8$
   E. None of the above

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

$|x+8|=2$

10. (5 points) Find all solutions to the equation $|6x-3|=6x$.

   A. $x=12$
   B. $x=3$
   C. $x=6$
   D. $x=\frac{1}{4}$
   E. No solution exists

$|6x-3|=6x$

$6x-3=6x$ $\quad -6x \quad -6x$

$-3=0$ No solution

$6x-3=-6x$ $\quad -6x \quad -6x$

$-3=-12x$

$\frac{-3}{-12}=\frac{-12x}{-12}$

$\frac{1}{4}=x$

Check $x=\frac{1}{4}$

$\left|6\cdot\frac{1}{4}-3\right| \stackrel{?}{=} 6\left(\frac{1}{4}\right)$

$\left|\frac{3}{2}-\frac{3}{1}\right| \stackrel{?}{=} \frac{3}{2}$

$\left|\frac{3}{2}-\frac{6}{2}\right| \stackrel{?}{=} \frac{3}{2}$

$\left|-\frac{3}{2}\right| = \frac{3}{2}$ ✓

11. (5 points) Which of the following equations is equivalent to $3x^2-24x+7=0$?

   A. $(x+4)^2=\frac{41}{3}$
   B. $(x-4)^2=\frac{41}{3}$
   C. $(x+4)^2=7$
   D. $(x+4)^2=41$
   E. $(x-4)^2=41$

$3(x^2-8x+16-16)+7=0$

$\left(\frac{b}{2}\right)^2=\left(\frac{-8}{2}\right)^2=(-4)^2=16$

$3(x^2-8x+16)-48+7=0$

$3(x+\frac{-8}{2})^2-41=0$

$3(x-4)^2-41=0$

$+41 \quad +41$

$\frac{3(x-4)^2}{3}=\frac{41}{3}$

$(x-4)^2=\frac{41}{3}$

12. (5 points) Solve for y in $6y^2+3y=1$.

   A. $y=\frac{3\pm\sqrt{15}}{12}$
   B. $y=-\frac{1}{4}$
   C. $y=\frac{-3\pm\sqrt{33}}{12}$
   D. $y=\frac{3\pm\sqrt{33}}{12}$
   E. $y=\frac{-3\pm\sqrt{15}}{12}$

$-1 \quad -1$

$6y^2+3y-1=0$

$a=6$
$b=3$
$c=-1$

$\frac{-3\pm\sqrt{3^2-4(6)(-1)}}{2(6)}=\frac{-3\pm\sqrt{9+24}}{12}=\frac{-3\pm\sqrt{33}}{12}$

13. (5 points) Solve for z in the equation $\dfrac{(z-3)^2}{8} = 2$.

A. $z = 3, z = -3$

B. $z = 2$

C. $z = 3$

D. $z = -1, z = 6$

E. $z = -1, z = 7$

$8\left(\frac{(z-3)^2}{8}\right) = (2)8$

$(z-3)^2 = 16$

$z - 3 = \pm\sqrt{16}$

$z - 3 = \pm 4$

$z - 3 = 4$ $\quad z - 3 = -4$

$+3 \quad +3 \quad +3 \quad +3$

$z = 7 \quad z = -1$

14. (5 points) Find all real solutions to the equation

$$x^4 - 5x^2 - 36 = 0$$

A. $x = 3$

B. $x = 3$ and $x = -3$

C. $x = 2$, $x = -2$, $x = 3$ and $x = -3$

D. $x = 2$ and $x = -2$

E. None of the above

$u^2 - 5u - 36 = 0$

$u^2 + 4u - 9u - 36 = 0$

$u(u+4) - 9(u+4) = 0$

$(u-9)(u+4) = 0$

Let $u = x^2$ ← multiply

then $u^2 = (x^2)^2$

so $u^2 = x^4$

$u - 9 = 0$ or $u + 4 = 0$

$+9 \quad +9 \quad -4 \quad -4$

$u = 9 \quad u = -4$

$x^2 = 9 \quad x^2 = -4$

$x = \pm\sqrt{9}$ No real solutions

$x = \pm 3$

15. (5 points) Find all real solutions to the equation

$$2x^3 = 18x$$

$-18x \quad -18x$

A. $x = 0$, $x = 3$, and $x = -3$

B. $x = 0$ and $x = 9$

C. $x = -3$ and $x = 3$

D. $x = 9$

E. None of the above

$2x^3 - 18x = 0$

$2x(x^2 - 9) = 0$

$2x(x-3)(x+3) = 0$

$\frac{2x}{2} = \frac{0}{2}$, $x - 3 = 0$ or $x + 3 = 0$

$+3 \quad +3 \quad -3 \quad -3$

$x = 0 \quad x = 3 \quad x = -3$

16. (5 points) Find all real solutions to the equation

$$\sqrt[2]{23 - x} = x - 3$$

Recall: $\sqrt[n]{a} = b$ means $b^n = a$

A. $x = 7$ and $x = -2$

B. $x = 7$

C. $x = -2$

D. There are no real solutions

E. None of the above

$(x-3)^2 = 23 - x$

$(x-3)(x-3) = 23 - x$

$x^2 - 6x + 9 = 23 - x$

$-23 \quad -23$

$x^2 - 6x - 14 = -x$

$+x \quad +x$

$x^2 - 5x - 14 = 0$

$x^2 + 2x - 7x - 14 = 0$

$x(x+2) - 7(x+2) = 0$

$(x-7)(x+2) = 0$

$x - 7 = 0$ $\quad x + 2 = 0$

$+7 \quad +7 \quad -2 \quad -2$

$x = 7 \quad x = -2$

Check $x = 7$

$\sqrt{23 - 7} \stackrel{?}{=} 7 - 3$

$\sqrt{16} = 4$ ✓

Check $x = -2$ ← not a solution

$\sqrt{23 - (-2)} \stackrel{?}{=} -2 - 3$

$\sqrt{25} \stackrel{?}{=} -5$

$5 \neq -5$ ☹

17. (5 points) Choose the coordinate located on the line $4x + 3y - 2 = 0$

A. $\left(2, \frac{-10}{3}\right)$ $4(2)+3\left(\frac{-10}{3}\right)-2 = 8-10-2 = -2-2 = -4 \neq 0$

B. $\left(\frac{-10}{3}, 2\right)$ $4\left(\frac{-10}{3}\right)+3(2)-2 = -\frac{40}{3}+\frac{6}{1}-\frac{2}{1} = -\frac{40}{3}+\frac{18}{3}-\frac{6}{3} = -\frac{28}{3} \neq 0$

C. $(2, -2)$ $4(2)+3(-2)-2 = 8-6-2 = 2-2 = 0$ ☺

D. $(-2, 2)$ $4(-2)+3(2)-2 = -8+6-2 = -2-2 = -4 \neq 0$

E. None of the points are on the line.

18. (5 points) Find the center and radius of the circle defined by the equation $x^2 + 4x + y^2 - 12 = 0$

A. The center is at $(2, 0)$ with $r = 4$.

B. The center is at $(-2, 0)$ with $r = 16$.

C. The center is at $(-2, 0)$ with $r = 4$.

D. The center is at $(0, -2)$ with $r = 4$.

E. The center is at $(-2, -2)$ with $r = 16$.

$(x^2+4x+4)+y^2 = 12+4$ $\left(\frac{4}{2}\right)^2 = 2^2 = 4$

$(x+\frac{4}{2})^2 + y^2 = 16$

$(x+2)^2 + y^2 = 16$ Center $= (h,k) = (-2,0)$

$(x-(-2))^2 + (y-0)^2 = 4^2$ radius $= r = 4$

$(x-h)^2 + (y-k)^2 = r^2$

19. (5 points) Find the y-intercept of the line passing through the points $(1, 1)$ and $(4, 3)$.

A. $\frac{1}{3}$

B. $\frac{2}{3}$

C. $-\frac{1}{2}$

D. $\frac{3}{2}$

E. None of the above

x_1, y_1 x_2, y_2

$\text{slope} = m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3-1}{4-1} = \frac{2}{3}$

$y - 1 = \frac{2}{3}(x-1)$

$y - 1 = \frac{2}{3}x - \frac{2}{3}$

$+1 \quad +1$

$y = \frac{2}{3}x + \frac{1}{3}$ ← y-intercept

20. (5 points) Which of the following lines is perpendicular to the line passing through the points $(0, 3)$ and $(4, 0)$?

$x_1\ y_1$ $x_2\ y_2$

A. $y = \frac{3}{4}x - 3$

B. $y = -\frac{3}{4}x + 3$

C. $y = -\frac{4}{3}x + \frac{16}{3}$

D. $y = \frac{4}{3}x - \frac{16}{3}$

E. None of the above

$\text{slope} = m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0-3}{4-0} = \frac{-3}{4}$

$\perp\ m = \frac{4}{3}$