Math 1314 ONLINE
Week 1 – Notes

Lesson 1: Prerequisites

Prerequisites are topics you should have mastered before you enter this class. Because of the emphasis on technology in this course, there are few skills which you will have to do by hand. This lesson is intended as a quick review of these topics.

1. Simplifying an algebraic expression

Example 1: Simplify: $12(3-4x)-2(x+5)$

Example 2: Simplify: $x-2p^2+4-\left(-4p^2+6x\right)-8x$

Example 3: Simplify: $-2x^2\left(4-3x\right)-2x\left(4x^2+x-4\right)$

2. Solving an equation for a variable

Example 4: Solve for x: $5x+2y=-9$

Example 5: Solve for p: $\quad 4x - \dfrac{1}{2}y - \dfrac{2}{3}p = 8 - 3a$

Example 6: Solve for x: $\quad -0.03x + 150 = p$

3. Solve systems of equations

Example 7: Solve the system:

$$3x - 2y = 11$$
$$x + 4y = 13$$

Example 8: Solve the system:

$$6x = 42$$
$$y^2 - y = 20$$

Example 9: Solve the system:

$$4x^2 - 5y = 0$$
$$-8x + 5y = 12$$

4. Writing equations of lines

$y = mx + b$ $m = $ slope $b = y$ int.

Example 10: Write an equation of the line that passes through the point (0, 7) and has slope $\dfrac{-2}{7}$

$\underset{b}{}$ $\underset{m}{}$

$\boxed{y = -\frac{2}{7}x + 7}$

Example 11: Suppose the slope of a line is $\overset{m}{\frac{1}{3}}$ and the line passes through the point $(-3, 7)$. ← not the y int

Write the equation of the line.   find b

$y = mx + b$

$7 = \frac{1}{3}(-3) + b$

$7 = -1 + b$

$8 = b$

$\boxed{y = \frac{1}{3}x + 8}$

Example 12: Write an equation of the line that passes through the points $\overset{x_1, y_1}{(-1, 6)}$ and $\overset{x_2, y_2}{(3, -4)}$.

$m = \dfrac{y_2 - y_1}{x_2 - x_1}$

$m = \dfrac{-4 - 6}{3 - (-1)} = \dfrac{-10}{4} = \dfrac{-5}{2}$

$6 = -\frac{5}{2}(-1) + b$

$6 = \frac{5}{2} + b$

$\dfrac{6 - \frac{5}{2}}{1} = b$

$\dfrac{12}{2} - \dfrac{5}{2} = b$

$\dfrac{7}{2} = b$

$\boxed{y = -\frac{5}{2}x + \frac{7}{2}}$

5. Using function notation

Example 13: If $f(x) = 2x^2 - 8x + 3$, find $f(-2)$, $f(0)$ and $f(4+h)$.

$f(-2) = 2(-2)^2 - 8(-2) + 3$
$= 2(4) + 16 + 3 = 8 + 16 + 3 = \boxed{27}$

$f(0) = 2(0)^2 - 8(0) + 3 = 3$

$f(4+h) = 2(4+h)^2 - 8(4+h) + 3$
$= 2(4+h)(4+h) - 8(4+h) + 3$
$= 2(16 + 4h + 4h + h^2) - 32 - 8h + 3$
$= 32 + 8h + 8h + 2h^2 - 32 - 8h + 3 = \boxed{3 + 8h + 2h^2}$

Example 13: Use the piecewise-defined function below to find $f(5)$ and $f(-3)$.

$$f(x) = \begin{cases} 3x^2 + 4x - 2, & x < -1 \\ x + 5, & x \geq -1 \end{cases}$$

$5 \geq -1$

$-3 < -1$

$f(5) = 5 + 5 = 10$

$f(-3) = 3(-3)^2 + 4(-3) - 2$
$= 3(9) - 12 - 2 = 27 - 12 - 2 = \boxed{13}$

6. Using interval notation

Example 14: Write using interval notation: $x \geq 2.7$

2.7

$[2.7, \infty)$

Example 15: Write using interval notation: $3 \leq x < 17$

3   17

$[3, 17)$

Example 16: Write using interval notation: $x < -7$

-7

$(-\infty, -7)$

$(2, 5)$

7. Using scientific notation

Example 17: Write in decimal form: 2.165×10^6

$$2,165,000$$

+ exponent; move decimal point 6 places to the right

Example 18: Write in decimal form: 1.629×10^{-4}

$$0.0001629$$

− exponent; move d.p. 4 places left

✳ **Example 19:** Write in decimal form: 9.1286E^{-16}

$$9.1286 \times 10^{-16}$$

$$0.000000\ 000000\ 00091286 \approx 0$$

8. Exponents

Example 20: Simplify and write the answer without using negative exponents: $\dfrac{x^{-3}}{1}$

$$\frac{1}{x^3}$$

Example 21: Simplify and write the answer without using negative exponents: $\dfrac{2x^{-5}}{1}$

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

$$\frac{3}{x^{-2}} = 3x^2$$

$$\frac{5}{x^4} = 5x^{-4}$$

Example 22: Write using rational exponents: $\sqrt[3]{x^5}$

power/root

$$x$$

$$\boxed{x^{5/3}}$$

Example 23: Write using a radical sign: $x^{\frac{3}{4}}$

$$\boxed{\sqrt[4]{x^3}}$$

9. Multiplying Binomials and Factoring

Example 24: Multiply: $(4x-1)(2x+3)$ $= 8x^2 + 12x - 2x - 3$

$$= \boxed{8x^2 + 10x - 3}$$

Example 25: Multiply: $(x+6)^2$ $= (x+6)(x+6)$

$$= x^2 + 6x + 6x + 36$$

$$= \boxed{x^2 + 12x + 36}$$

Example 26: Factor: $x^2 - x - 30$

$$(x - 6)(x + 5)$$

Example 27: Factor: $x^2 - 36$

$$(x - 6)(x + 6)$$

$$x^2 - a^2$$
$$(x - a)(x + a)$$

10. Domain

Example 28: Find the domain: $f(x) = \sqrt{x-3}$

$x - 3$ can't be −

even index

$$x - 3 \geq 0$$
$$\boxed{x \geq 3}$$
$$\boxed{[3, \infty)}$$

$g(x) = \sqrt[3]{x+4}$
$(-\infty, \infty)$

Example 29: Find the domain: $g(x) = \dfrac{x-5}{x-2}$

denom $\neq$ 0

$$x - 2 \neq 0$$
$$\boxed{x \neq 2}$$
$$\boxed{(-\infty, 2) \cup (2, \infty)}$$

Example 30: Find the domain: $h(x) = \dfrac{4x^2 + 7}{x^2 - 4}$

$x^2 - 4 \neq 0$

$(x-2)(x+2) \neq 0$

$x - 2 \neq 0 \qquad x + 2 \neq 0$

$x \neq 2, \quad x \neq -2$

$x \neq \pm 2$

$(-\infty, -2) \cup (-2, 2) \cup (2, \infty)$

Example 31: Find the domain: $k(x) = 3e^x - 5$

$(-\infty, \infty)$

Example 32: Find the domain: $m(x) = 4x^2 - 8x + 11$

$(-\infty, \infty)$

11. Asymptotes

Example 33: Find any vertical and/or horizontal asymptotes: $f(x) = \dfrac{6x - 2}{2x + 5}$

$\deg = 1$
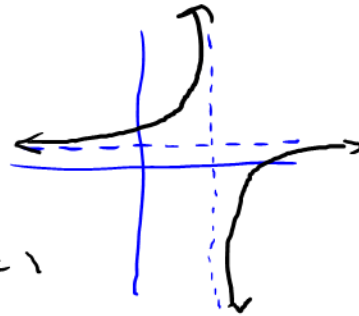
$\deg = 1$

V.A. den $= 0$ solve for x

$2x + 5 = 0$

$2x = -5$

$x = \dfrac{-5}{2}$

H.A.

$y = \dfrac{6}{2} = 3$

$y = 3$

Example 34: Find any vertical and/or horizontal asymptotes: $g(x) = \dfrac{x^2 - 4x + 3}{x^2 - 1}$

$g(x) = \dfrac{(x-3)(x-1)}{(x-1)(x+1)}$

continue
within → $h(x) = \dfrac{x-3}{x+1}$

V.A. $x + 1 = 0$

$x = -1$

H.A. $y = 1$

hole @ $x - 1 = 0$

hole @ $x = 1$

exponents are the same

bobo   both   eats   dc   divide coefficients

bigger on bottom $= 0$ bigger on top $=$ none

$$f(x) = \frac{x+3}{x^2 - 6x + 5} \qquad \begin{array}{l} \deg = 1 \\ \deg = 2 \\ bobo \end{array}$$

$$\boxed{y = 0}$$

$$g(x) = \frac{7x^3 - 8x + 5}{x^2 - 9x + 1} \qquad \begin{array}{l} \deg = 3 \\ \deg = 2 \\ botn \end{array}$$

$$\boxed{no \quad H.A.}$$