

1. (3pts) Identify each of the following numbers as integer, rational or irrational.

$$\frac{7}{6}$$

rational

$$\sqrt{7}$$

irrational

$$4.26333333 \dots \text{ (3's repeat)}$$

rational

~~irrational~~

2. (2pts) Convert to or from scientific notation:

$$3.57 \times 10^5 = 357,000$$

$$0.000492 = 4.92 \times 10^{-4}$$

4 places

3. (4pts) Simplify and write the answer so all exponents are positive:

$$\frac{(3x)^2(x^2y^2)^4}{x^{-5}(6y)^2} = \frac{9x^2 \times y^8}{x^{-5} 36y^2} = \frac{9x^{10}y^8}{36x^{-5}y^2} = \frac{x^{10-(-5)}y^{8-2}}{4} = \frac{x^{15}y^6}{4} = \frac{x^{15}}{4y^6}$$

4. (4pts) Simplify.

$$\begin{aligned} \frac{x+2}{x^2+4x} - \frac{x-1}{x^2+x-12} &= \frac{x+2}{x(x+4)} - \frac{x-1}{(x-3)(x+4)} \\ &= \frac{(x+2)(x-3) - x(x-1)}{x(x+4)(x-3)} \\ &= \frac{x^2 - x - 6 - (x^2 - x)}{x(x+4)(x-3)} \\ &= \frac{-6}{x(x+4)(x-3)} \end{aligned}$$

5. (4pts) Use a known formula to factor:

$$4x^2 - 49 = (2x)^2 - 7^2 = (2x-7)(2x+7)$$

$$x^3 - 64 = x^3 - 4^3 = (x-4)(x^2 + 4x + 16)$$

6. (3pts) Which of the points $A = (-4, 5)$ and $B = (6, -2)$ is closer to the origin? Justify your answer by a computation.

$$d(A, 0) = \sqrt{(-4-0)^2 + (5-0)^2} = \sqrt{16+25} = \sqrt{41}$$

$$d(B, 0) = \sqrt{(6-0)^2 + (-2-0)^2} = \sqrt{36+4} = \sqrt{40} \text{ smaller}$$

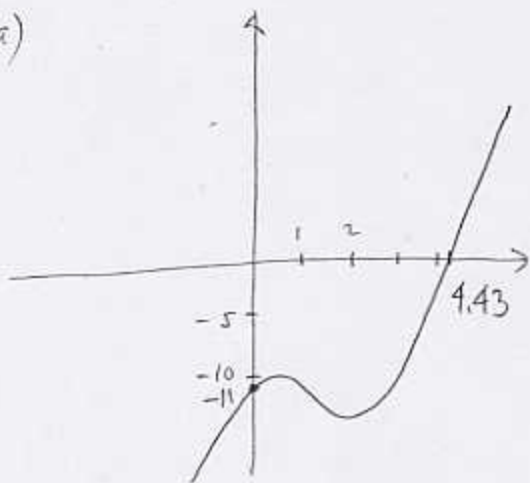
B is closer to $(0, 0)$,

7. (5pts) The equation $y = x^3 - 5x^2 + 5x - 11$ is given.

a) Use your calculator to help you sketch the graph (yes, on paper!). Make sure all the features of the graph are visible and indicate your viewing window.

b) Find the all the x -intercepts and the y -intercept to two decimal places.

a)



$$y\text{-int: } -11 \text{ (put } x=0)$$

$$x\text{-int: } 4.43$$

$$[-5, 5] \times [-20, 20]$$

8. (15pts) Solve the equations for x .

$$cx - d^2x + d = c^2x + 3c - 4d$$

$$cx - d^2x - c^2x = 3c - 4d - d$$

$$x(c - d^2 - c^2) = 3c - 4d - d$$

$$x = \frac{3c - 5d}{c - d^2 - c^2}$$

$$x^2 - 3x = 5x - 15$$

$$x^2 - 8x + 15 = 0$$

$$(x-5)(x-3) = 0$$

$$x = 3, 5$$

$$|4x - 3| = 17$$

$$4x - 3 = 17 \text{ or } 4x - 3 = -17$$

$$4x = 20 \quad 4x = -14$$

$$x = 5 \quad x = -\frac{14}{4} = -\frac{7}{2}$$

$$x^4 - 2x^2 - 3 = 0$$

$$\text{Let } u = x^2$$

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

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

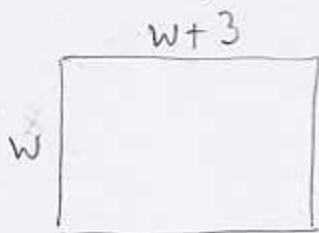
$$u = 3, -1$$

$$x^2 = 3 \quad x^2 = -1$$

$$\boxed{x = \pm\sqrt{3}}$$

no sol.

9. (4pts) The perimeter of a rectangle is 27in. If the length is 3in greater than the width, what is the size of the rectangle?



$$2w + 2(w+3) = 27$$

$$4w + 6 = 27$$

$$4w = 21$$

$$w = \frac{21}{4} = 5.25 \text{ in}$$

Size of rectagle: $5.25 \times 8.25 \text{ in}$

10. (6pts) How many milliliters of a 30% solution of sulphuric acid needs to be added to 100ml of a 5% solution in order to get a 20% solution? Don't forget to write down what your variable means.

$$\begin{array}{ccc} \text{30\%} & + & \text{5\%} & = & \text{20\%} \\ \text{x} & & \text{100ml} & & \text{x+100} \end{array}$$

$$\begin{array}{ccc} \text{0.3x} & & \text{0.05} \cdot \text{100} & & \text{0.20(x+100)} \end{array}$$

pure acid

x = amount in ml of the 5% solution

$$0.3x + 5 = 0.20(x + 100)$$

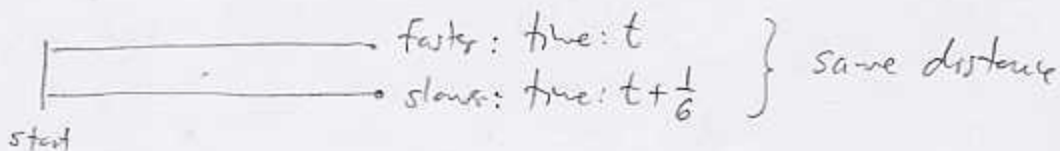
$$0.3x + 5 = 0.2x + 20$$

$$0.1x = 15$$

$$x = \frac{15}{0.1} = 150 \text{ ml}$$

Bonus. (5pts) Two cars drive along the same highway and start in the same spot. The faster car drives 55mph and the slower 40mph. If the faster car starts 10 minutes after the slower car, in how many minutes does it catch up with the slower car?

t = time the faster car drives, in hours



$$55t = 40\left(t + \frac{1}{6}\right)$$

$$55t = 40t + \frac{40}{6}$$

$$15t = \frac{40}{6}$$

$$t = \frac{40}{90} = \frac{4}{9} \text{ hr} = 26.67 \text{ minutes}$$