MATHEMATICS ASSESSMENT FOR CHEMISTRY AND PHYSICS INFORMATION SHEET
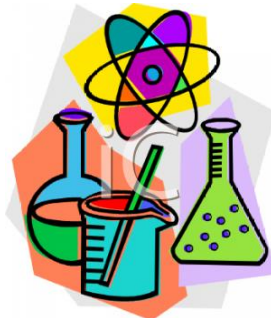

❏ As a student in INCHEM 111 or INPHYS 141, you will be required to take a mathematics assessment exam to evaluate your math skills.

❏ The assessment exam consists of the following seven sections:

- Ratios, Proportions, and Percents
- Scientific Notation, Order of Operations, and Significant Figures
- Solving Equations and Formulas
- SI Units and Conversions
- Logarithms
- Graphing
- Trigonometry and Quadratic Formula (This 7th section will only be taken by students enrolled in INPHYS 141.)

❏ Each section of the exam contains 6 multiple choice questions and will be taken on the computer at the Math Center.

❏ You will need to bring a scientific or graphing calculator with you when you take the assessment exam.

❏ Based on your results on the assessment exam, you will be advised of any next steps to prepare you for the mathematical content in INCHEM 111 and/or INPHYS 141.

❏ To schedule an appointment to take the exam or if you have any questions, please contact Allysha (Lisha) Hunter, Math Center Testing Coordinator, at Allysha.Hunter@keene.edu.

❏ The following pages include <u>sample questions</u> and solutions to problems similar to those you will find on the assessment exam. It is in your best interest to do these problems and seek help if you are having trouble agreeing with the correct answer. Tutors are available during the fall and spring semesters at The Math Center, 88 Winchester St., room 101. For specific tutoring times visit www.keene.edu/mathctr

SAMPLE QUESTIONS FOR THE

MATHEMATICS ASSESSMENT FOR CHEMISTRY AND PHYSICS

1) What is 120% of 1435?

2) In one mole of sucrose (sugar), the mass of carbon is 144 g, the mass of hydrogen is 22 g, and oxygen is 176 g. What percentage of sucrose is oxygen by mass?

3) Use the order of operations to simplify: 5.6 – 2.00(7.3 + 8.2)

4) Divide and express the answer in scientific notation: $\dfrac{5.36 \times 10^{-15}}{2.07 \times 10^{-4}}$

5) Write the product with the correct number of significant digits: $(5.03)(0.08)$

6) In a solution of water and alcohol, the ratio of water to alcohol is 4 to 1. If there are 35 liters of the solution, how many liters of water are there?

7) Given d = rt, when r = 55 mph and d = 385 miles, find t.   Be sure to include proper units.

8) Given $F = \dfrac{9}{5}C + 32$, when F = 68°, find C.

9) Solve each of the following equations for the indicated variable.

   a)   for x: $5(x+3) - 4(x-1) = -12$

   b)   for x: $z = \dfrac{x-y}{3}$

10) At Rent-A-Car, it costs $50/day and $0.20/mile to rent a sedan. Write an equation that can be used to model the cost of renting a sedan for one day.

11) For the following questions, first look at the given examples of common and natural logarithms, then determine the value of x.

   Common logarithm: $\log 36 = \log_{10} 36 = 1.56$, because $10^{1.56} = 36$.
   Natural logarithm: $\ln 36 = \log_e 36 = 3.58$, because $e^{3.58} = 36$.   *(e = 2.71828…)*

   a) $\ln x = 4.12$ b) $10^x = 22.4$

12) Complete the following conversion: 1 mg = _____ kg

   (Recall that 1kg = 1000g and 1g = 1000mg. A conversion table will be given to you during the exam.)

13) Convert "a 12.0 oz can of soda" to an appropriate metric unit.   (In other words, it would be appropriate to give a person's weight in pounds or kilograms, but not in ounces or grams.

14) Convert 25 miles per hour to feet per second.

15) Chemists often give the composition of a mixture as mass per unit volume. For example, if 1.4 g of table sugar is dissolved in 7.0 mL of water, we say there is 1.4g / 7.0 mL = 0.20 g/mL of sugar in the solution. Express this same concentration as mg/mL.

16) Is the point (-8,5) a solution to the equation $y = \frac{1}{2}x + 9$?

17) The graph below shows a linear function for the cost of renting a particular graphing calculator.

Cost of Renting a Graphing Calculator

Cost (in $) vs Number of Months Rented
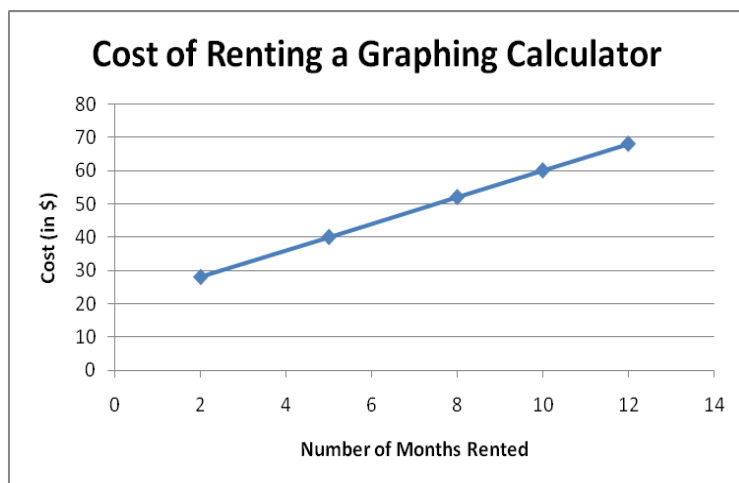
a)   Determine the rate at which the cost of renting this particular calculator increases per month.
b)   Estimate the cost of renting this particular calculator for
    i.   9 months.
    ii.   14 months.

| Sample questions that will be in the trigonometry and quadratic formula section. |
| --- |

18) Use the quadratic formula $\left(x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \right)$ to solve the following problem. A projectile is launched from ground level. The height, h (in meters), above the ground t seconds later is given by $h = -4.9t^2 + 50t$. How many seconds will it take the projectile to hit the ground from the time it was launched?

19) A
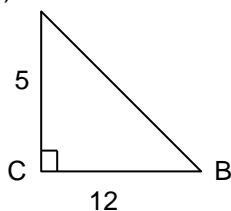
Find the measure of angle A in degrees to the nearest tenth of a degree.

5

C   B
   12

3

20) A

37°

15 miles

C ⊾ B
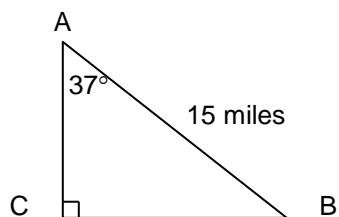
Find the length of x in miles to the nearest whole number.

ANSWERS

Worked out solutions can be found below these answers.

1) 1722   2) 51.5%   3) -25.4   4) 2.59×10^{-11} 5) 0.4   6) 28L

7) 7.0 hours   8) C = 20°   9) a) -31 b) $x = y + 3z$ 10) $C = 0.20m + 50$

11) a) $x = 61.6$ b) $x = 1.35$ 12) $1 \times 10^{-6} kg$ 13) 12.0 oz = 355 mL

14) 37 ft/sec   15) $200 \dfrac{mg}{mL}$ 16) yes

17) a) The cost increases $4/month   b) i. about $55   b) ii. about $76

18) 10 seconds   19) $67.4°$ 20) 9 miles

SOLUTIONS

1)
$n = 1.20 \bullet 1435$
$n = 1722$

2)   Find the total mass: $144\,g + 22\,g + 176\,g = 342\,g$
Divide mass of oxygen by total mass and multiply by 100 to write as a percent:

$$\frac{176\,g}{342\,g} \times 100 = 51.5\%$$

3) $5.6 - 2.00(7.3 + 8.2) = 5.6 - 2.00(15.5) = 5.6 - 31.0 = -25.4$

4)   Use the EE or EXP key on your calculator to type in each scientific number:

$5.36 \ EE - 15 \ / \ 2.07 \ EE - 4 = 2.59 \times 10^{-11}$

5) $(5.03)(0.08) = 0.4024 = 0.4$

Since 5.03 has 3 significant digits and 0.08 has 1 significant digit, the answer needs to have 1 significant digit.

6)   Total solution is 5, so we get the proportion:

$$\frac{4 \ water}{5 \ solution} = \frac{x \ water}{35 \ solution}$$

$$5x = 35(4) \qquad \text{There are 28 L of water in the 35 L solution.}$$

$$5x = 140$$

$$x = 28$$

$$d = rt$$

7) $385 = 55t \qquad$ Time would equal 7.0 hours.

$$t = 7.0$$

$$F = \frac{9}{5}C + 32$$

$$68 = \frac{9}{5}C + 32$$

8)   C would equal $20°$.

$$\frac{5}{9} \bullet 36 = \frac{9}{5}C \bullet \frac{5}{9}$$

$$20 = C$$

9) a) $5(x + 3) - 4(x - 1) = -12$ b) $3 \bullet z = \frac{x - y}{3} \bullet 3$

           $5x + 15 - 4x + 4 = -12$

           $x + 19 = -12$ $3z = x - y$

           $x = -31$ $x = y + 3z$

10) Let C = cost and m = miles then $C = 0.20m + 50$

11) a)   To solve a logarithmic equation, you need to write it in exponential form.

In $x = 4.12$ so that means the base is e, the exponent is 4.12 and it equals x: $e^{4.12} = x$

                                                                              $x = 61.6$

11) b) To solve an exponential equation, you need to take the log of both sides.

$$10^x = 22.4$$

$$\log 10^x = \log 22.4 \qquad \text{(Recall that } \log 10^x = x.\text{)}$$

$$x = \log 22.4$$

$$x = 1.35$$

For #12 – 15, the unit fraction method is used to convert units.

12) $\qquad 1\ mg \times \dfrac{1\ g}{1000\ mg} = \dfrac{1\ kg}{1000\ g} = 1 \times 10^{-6}\ kg$

13) $\qquad$ An appropriate metric unit for ounces would be milliliters.

$$12.0\ oz \times \dfrac{1\ pt}{16\ oz} \times \dfrac{1\ qt}{2\ pt} \times \dfrac{1\ L}{1.057\ qt} \times \dfrac{1000\ mL}{1\ L} = \dfrac{12000\ mL}{33.824} = 354.778\ mL = 355\ mL$$

14) $\qquad \dfrac{25\ mi}{1\ hr} \times \dfrac{5280\ ft}{1\ mi} \times \dfrac{1\ hr}{60\ min} \times \dfrac{1\ min}{60\ sec} = \dfrac{132000\ ft}{3600\ sec} = 37\ ft/\sec$

15) $\qquad \dfrac{0.20\ g}{1\ mL} \times \dfrac{1000\ mg}{1\ g} = \dfrac{200\ mg}{1\ mL} = 200\ mg/mL$

16) $\qquad$ To determine if (-8, 5) is a solution to $y = \dfrac{1}{2}x + 9$, substitute –8 for x and 5 for y.

$$y = \dfrac{1}{2}x + 9 \qquad\qquad \text{Since the statement is true,} \quad (-8,5) \text{ is a solution to } y = \dfrac{1}{2}x + 9.$$

$$5 = \dfrac{1}{2}(-8) + 9$$

$$5 = -4 + 9$$

$$5 = 5$$

17) a) Using the points (5, 40) and (10, 60): $\quad$ rate = slope = $\dfrac{change\ in\ output}{change\ in\ input} = \dfrac{60 - 40}{10 - 5} = \dfrac{20}{5} = 4$

The cost increases at a rate of $4 per month.

17) b) i. Find 9 on the x-axis and draw a vertical line until it hits the graph, then draw a horizontal line until it hits the y-axis and estimate the y-value. It will cost about $55 to rent the calculator for 9 months.

17) b) ii. Extend the graph, then find 14 on the x—axis and draw a vertical line until it hits the extension of the graph. From that point, draw a horizontal line until it hits the y-axis and estimate the y-value. It will cost about $76 to rent the calculator for 14 months.

18)

$$h = -4.9t^2 + 50t \qquad\qquad h = 0$$

$$0 = -4.9t^2 + 50t \qquad\qquad a = -4.9 \quad b = 50 \quad c = 0$$

$$t = \frac{-50 \pm \sqrt{50^2 - 4(-4.9)(0)}}{2(-4.9)}$$

$$= \frac{-50 \pm \sqrt{2500}}{-9.8}$$

$$= \frac{-50 \pm 50}{-9.8}$$

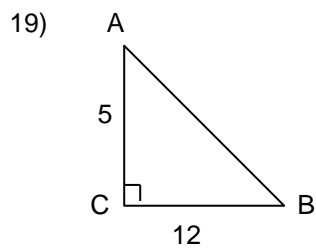$$t = \frac{-50 + 50}{-9.8} = 0 \qquad\qquad t = \frac{-50 - 50}{-9.8} = \frac{-100}{-9.8} = 10$$

It will take the projectile 10 seconds to hit the ground.

For #19 and 20, recall that

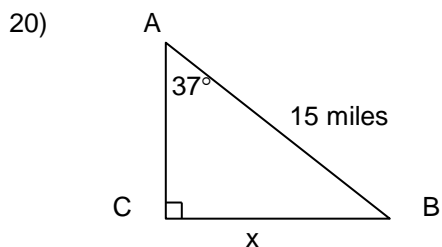$$\sin A = \frac{side\ opposite\ to\ \angle A}{hypotenuse} \qquad \cos A = \frac{side\ adjacent\ to\ \angle A}{hypotenuse} \qquad \tan A = \frac{side\ opposite\ to\ \angle A}{side\ adjacent\ to\ \angle A}$$

19)

$$\tan A = \frac{12}{5}$$

$$A = \tan^{-1}\left(\frac{12}{5}\right)$$

$$A = 67.4°$$

20)

$$\sin 37° = \frac{x}{15}$$

$$15 \sin 37° = x$$

$$x = 9\ miles$$