Engineering Physics I
PHYS 1210

Name ACS

Spring 2015

Discussion 1 – Math Review

One of the most important skills you should be coming into this class with is good math skills – and not just calculus but also other math content such as algebra, trig, and graphing. Please answer the questions below to the best of your ability.

Show your work where applicable, and box your answer.

Scientific Notation

Rewrite the following numbers in normal notation. Box your final answer.

1) $3.69*10^4$ → 36,900 (4 spaces Bigger +)

2) $2.1*10^{-3}$ → 0.0021 (3 spaces smaller −)

Rewrite the following numbers in scientific notation. Box your final answer.

3) 0.138 (1 space) → 1.38×10^{-1} small −

4) 511,000 (5 spaces) → 5.11×10^5 big +

Unit Conversions

5) How many centimeters are in a foot? (1 in = 2.54 cm, 1 ft = 12 in)

$$\frac{1\,\text{ft}}{1\,\text{ft}} \cdot \frac{12\,\text{in}}{1\,\text{in}} \cdot \frac{2.54\,\text{cm}}{} = 30.48\,\text{cm}$$

6) How many cubic centimeters are in a cubic meter? (100cm=1m)

$$\frac{1\,\text{m}^3}{1\,\text{m}} \cdot \frac{100\,\text{cm}}{1\,\text{m}} \cdot \frac{100\,\text{cm}}{1\,\text{m}} \cdot \frac{100\,\text{cm}}{1\,\text{m}} = 100^3\,\text{cm}^3$$

$$= (10^2)^3\,\text{cm}^3 = 10^6\,\text{cm}^3$$

Algebra

7) $x^2 - x = 12$. x=?

$x^2 - x - 12 = 0$

$(x-4)(x+3) = 0$

$\boxed{x = 4,\ x = -3}$

8) $x = .5at^2 + vt$. x=32, t=4.0, v=?

$0.5 \cdot at^2 + vt - x = 0$

$0.5 \cdot a \cdot 4.0 + v \cdot 4.0 - 32 = 0$

$2a + 4v - 32 = 0$

$a + 2v - 16 = 0$

$2v = 16 - a$

$\boxed{v = 8 - \frac{1}{2}a}$

Literal Equations: Rewrite the following equations algebraically for the given variable.

9) $x = \frac{1}{2}at^2 + v_0 t + x_0$. v_0=?

$x - x_0 - \frac{1}{2}at^2 = v_0 t$

$\boxed{v_0 = \frac{x - x_0}{t} - \frac{1}{2}at}$

10) $F = \frac{GMm}{r^2}$. r=?

$r^2 = \frac{GMm}{F}$

$\boxed{r = \sqrt{\frac{GMm}{F}}}$

Linear equations (also known as simultaneous equations or parametric equations)

11) Given the two equations $y = 4.9t^2$ and $3.1 = 16t$, determine the value of y.

$\frac{3.1}{16} = t \rightarrow t = 0.2583$

$y = 4.9(0.2583)^2$

$y = 0.32700694 = \boxed{0.33}$

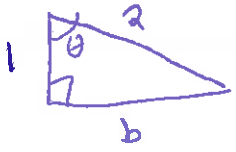
inputs have 2 digits

12) Given the two equations $y = \frac{1}{2}gt^2$ and $x = vt$, write an expression for v.

$2y = gt^2$ $\quad t = \sqrt{\frac{2y}{g}}$ $\quad v = \frac{x}{t} = x\sqrt{\frac{g}{2y}} = v$

Trigonometry

13) A right triangle has one leg of length 1, and a hypotenuse of length 2. Find (a) the length of the other leg, and (b) the angle adjacent to the leg of length 1.



a) $a^2 + b^2 = c^2$

$1^2 + b^2 = 2^2$

$b^2 = 4 - 1$

$b = \sqrt{3}$

b) "SOH CAH TOA"

$2\cos\theta = 1$

$\cos\theta = 0.5$

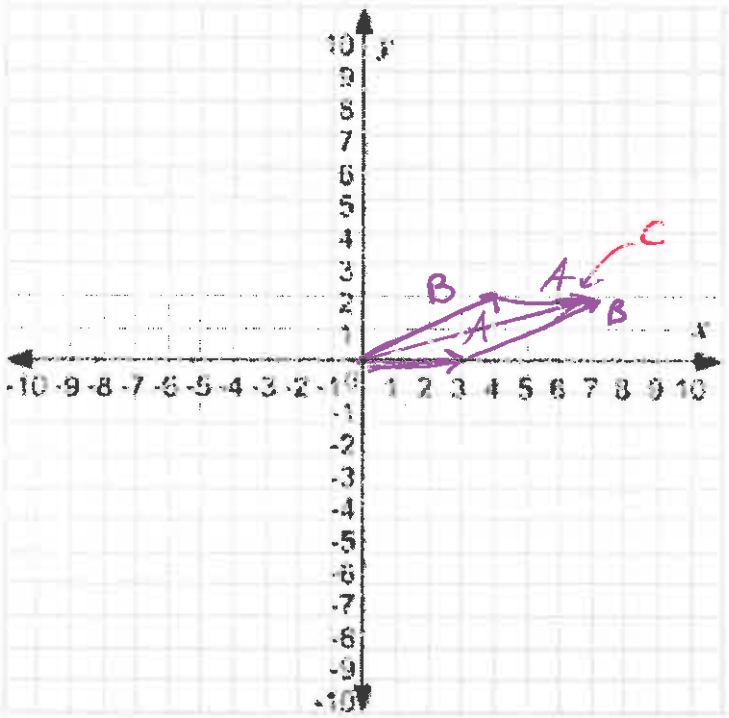
$\theta = 60^\circ$

For the following questions, use the vectors **A**=(3, 0) and **B**=(4, 2).

14) On the graph below, draw the vector **A**

15) Draw the vector **B**

16) Draw the vector sum, **C**=**A**+**B**



17) Calculate the magnitude of the vector **C**

$A = (3, 0)$
$B = (4, 2)$
$C = (7, 2)$

Pythag: "$a^2 + b^2 = c^2$"

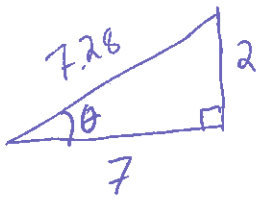
$7^2 + 2^2 = c^2$

$49 + 4 = c^2$

$53 = c^2$

$\boxed{c = 7.28}$

18) Calculate the direction of the vector C



SOHCAHTOA

$\tan\theta = \frac{2}{7}$

$\theta = \tan^{-1}(2/7)$

$\theta = 15.9453959...$ $\quad \boxed{\theta = 15.9^\circ}$

Calculus

Box your final answers.

19) Given the formula $f(x) = 3x^2 + 2x - 9$, determine $f'(x)$. ← derivative

$f'(x) = 2 \cdot 3x^1 + 2x^0 + 0$

$\boxed{f'(x) = 6x + 2}$

20) Given the same formula as in Problem 16, determine $f''(x)$.

$f'(x) = 6x + 2$ ← 2nd derivative

$\boxed{f''(x) = 6}$

21) Given the same formula as in Problem 16, determine $\int f(x)dx$

$\int f(x)dx = \int (3x^2 + 2x - 9)dx$

$= 3 \cdot \frac{1}{3}x^3 + 2 \cdot \frac{1}{2}x^2 - 9x$

$= \boxed{x^3 + x^2 - 9x} \ (+C)$

22) $\sum_{n=1}^{4} n^2 = ?$ Summation from 1 to 4

$1^2+2^2+3^2+4^2$

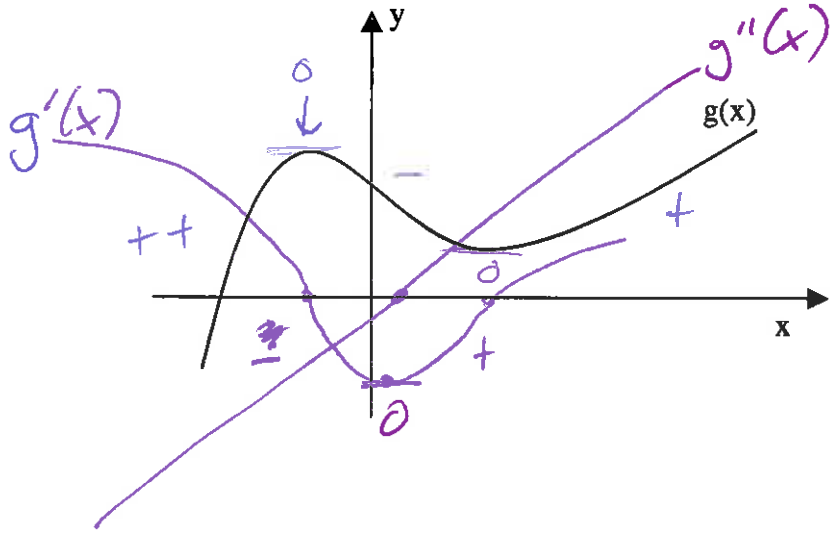
$= 1+4+9+16$

$= \boxed{30}$

23) The dot product uses the Cosine of the angle between two vectors, and the answer is a scalar.

Compare to cross product, which uses sine and gives a vector.

24) Sketch $g'(x)$ on the below graph.



25) Sketch $g''(x)$ on the above graph as well. Be sure to indicate which line is which.

Sanity check:

$g(x)$ is sorta like a cubic (x^3)

$g'(x)$ parabola or quadratic (x^2)

$g''(x)$ line (x)