# Formula Sheet

## Order of Operations

$$ac + bc = c(a + b)$$

### exponents

$$a^n a^m = a^{n+m}$$

$$(a^n)^m = a^{nm}$$
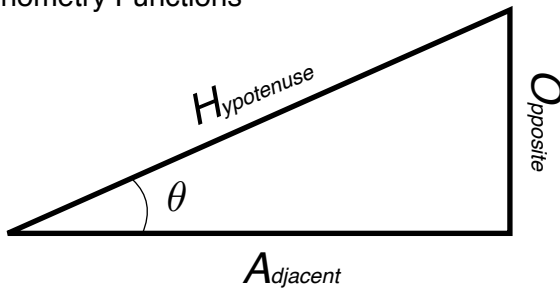
$$(ab)^n = a^n b^n$$

$$a^0 = 1$$

$$a^{-n} = \frac{1}{a^n}$$

### radicals

$$a^{\frac{n}{m}} = \sqrt[m]{a^n}$$

## Trigonometry Functions



$$sin(\theta) = \frac{O}{H} \qquad sin^{-1}\left(\frac{O}{H}\right) = \theta$$

$$cos(\theta) = \frac{A}{H} \qquad cos^{-1}\left(\frac{A}{H}\right) = \theta$$

$$tan(\theta) = \frac{O}{A} \qquad tan^{-1}\left(\frac{O}{A}\right) = \theta$$

## Pythagoras Theorem

$$H^2 = O^2 + A^2$$

## Relative Velocity

$$\vec{v}_{\frac{A}{C}} = \vec{v}_{\frac{A}{B}} + \vec{v}_{\frac{B}{C}}$$

$$\vec{v}_{\frac{B}{A}} = -\vec{v}_{\frac{A}{B}}$$

## Linear equations (Cramer's rule)

$$x_i = \frac{det(A_i)}{det(A)}$$

## Forms of a 1st order polynomial

$$y = ax + b$$

## Forms of a 2nd order polynomial

$$y = ax^2 + bx + c$$

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

$$y = a(x - m)(x - n)$$

## Quadratic Equation

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

## Unit Conversions

### angles

$$2\pi = 6.28 \text{ rad} = 360^o$$

### mass

$$1 \text{ kg} = 2.2 \text{ lbs.}$$

### lengths

$$1 \text{ mile} = 1.6 \text{ km}$$
$$1 \text{ inch} = 2.54 \text{ cm}$$
$$1 \text{ m} = 3.3 \text{ ft}$$

### volumes

$$1 \text{ gallon} = 3.78 \text{ Litres}$$

(2 marks) Solve the each expression and keep the correct number of significant digits.

(272.4)(0.0032) + 3.1

(2.43)(3839.506)+670

(2 marks) Given the standard unit conversion table on the formula sheet (1st page), convert each of the numbers to the stated units.

$$742.8 \ \frac{miles}{hour} \ \rightarrow \ \frac{km}{day}$$

$$2.3 \ \frac{gal^2}{hour} \ \rightarrow \ \frac{L^2}{second}$$

(4 marks) You run 120 m East, 100 m at $30^0$ North of West and 80 m at $60^0$ East of North.  How far are you from where you started?

(2 marks each) Solve for x in the following equations.

$$3x - \frac{2}{3}u^2 + \Gamma_o = ax + 1$$

$$\frac{ax - b_o}{3} - 3(x - b) = 2$$

$$\frac{x-1}{x+1} - 2a = b$$

$$\frac{2\sin(x^2-1) + a}{b-1} + c_o = 2$$

(4 marks) Solve for x and y in the following equation.

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

$$\frac{y+1}{x+1} = 2$$

(2 marks) Solve the each expression and keep the correct number of significant digits.

$$(\underset{4}{272.4})(\underset{2}{0.0032}) + 3.1 \;=\; \underset{+2}{0.\underset{2}{8}7168} \;+\; \underset{+1}{3.\underset{}{1}}$$

$$= \underset{+1}{3.97168}$$

$$\boxed{= 4.0}$$

$$(\underset{3}{2.43})(\underset{7}{3839.506}) + 670 \;=\; \underset{3}{\underset{-1}{9329.99958}} + \underset{-1}{670}$$

$$= \underset{-1}{9999.99958}$$

$$\boxed{= 1.000 \times 10^4}$$

(2 marks) Given the standard unit conversion table on the formula sheet (1st page), convert each of the numbers to the stated units.

$$742.8 \; \frac{miles}{hour} \;\rightarrow\; \frac{km}{day}$$

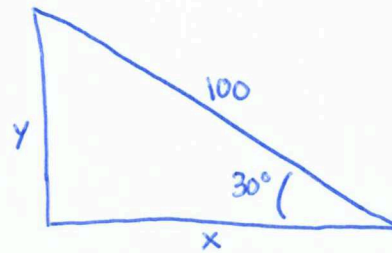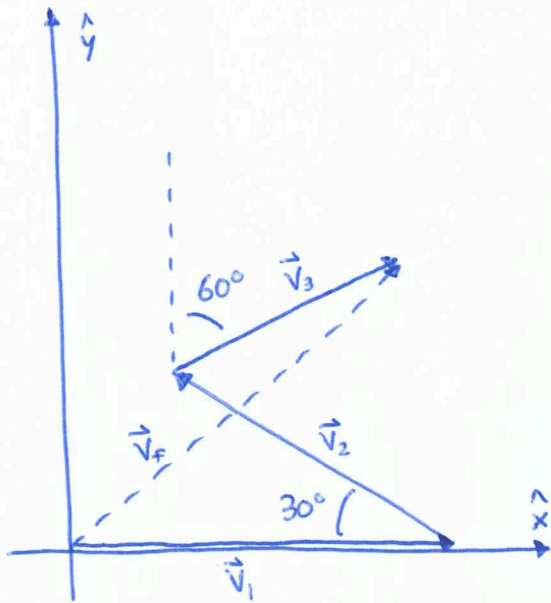$$742.8 \; \frac{\cancel{miles}}{\cancel{hour}} \left( \frac{1.6 \, km}{1 \, \cancel{mile}} \right) \left( \frac{24 \, \cancel{hour}}{1 \, day} \right) \;=\; \boxed{28\,524 \quad \frac{km}{day}}$$

$$2.3 \; \frac{gal^2}{hour} \;\rightarrow\; \frac{L^2}{second}$$

$$2.3 \; \frac{\cancel{gal^2}}{\cancel{hour}} \left( \frac{3.78 L}{1 \, \cancel{gal}} \right) \left( \frac{3.78 \, L}{1 \, \cancel{gal}} \right) \left( \frac{1 \, \cancel{hour}}{60 \, \cancel{min}} \right) \left( \frac{1 \, \cancel{min}}{60 \, sec} \right)$$

$$\boxed{\begin{array}{l} = 0.00913 \quad \frac{L^2}{sec} \\[2mm] = 9.13 \times 10^{-3} \quad \frac{L^2}{sec} \end{array}}$$

(4 marks) You run 120 m East, 100 m at 30⁰ North of West and 80 m at 60⁰ East of North.  How far are you from where you started?



$x = 100 \cos(30)$
$\quad = 86.60$
$y = 100 \sin(30)$
$\quad = 50$
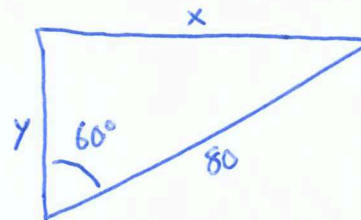
$x = 80 \sin(60)$
$\quad = 69.28$
$y = 80 \cos(60)$
$\quad = 40$

$\vec{V}_1 = \quad 120 \ \hat{x} \quad + \quad 0 \ \hat{y}$

$\vec{V}_2 = \ - 86.60 \ \hat{x} \quad + \quad 50 \ \hat{y}$

$+ \ \vec{V}_3 = \ 69.28 \ \hat{x} \quad + \quad 40 \ \hat{y}$

_____

$\vec{V}_F = \ 102.68 \ \hat{x} \quad + \quad 90 \ \hat{y}$

$\left| \vec{V}_F \right| = \sqrt{(102.68)^2 + (90)^2}$

$\quad = 136.54$

$\boxed{\left| \vec{V}_F \right| = 136.5 \ m}$

(2 marks each) Solve for x in the following equations.

$$3x - \frac{2}{3}u^2 + \Gamma_o = ax + 1$$

$$3x - ax = 1 + \frac{2}{3}u^2 - \Gamma_o$$

$$x(3-a) = 1 + \frac{2}{3}u^2 - \Gamma_o$$

$$x = \frac{1 + \frac{2}{3}u^2 - \Gamma_o}{3 - a}$$

$$= \frac{3 + 2u^2 - 3\Gamma_o}{9 - 3a}$$

$$\frac{ax - b_o}{3} - 3(x - b) = 2$$

$$\frac{a}{3}x - \frac{b_o}{3} - 3x + 3b = 2$$

$$\frac{a}{3}x - 3x = 2 + \frac{b_o}{3} - 3b$$

$$x\left(\frac{a}{3} - 3\right) = 2 + \frac{b_o}{3} - 3b$$

$$x = \frac{2 + \frac{b_o}{3} - 3b}{\frac{a}{3} - 3}$$

$$= \frac{6 + b_o - 9b}{a - 9}$$

$$\frac{x-1}{x+1} - 2a = b$$

$$x - 1 - 2a(x+1) = b(x+1)$$

$$x - 1 - 2ax - 2a = bx + b$$

$$x - 2ax - bx = 1 + 2a + b$$

$$x(1 - 2a - b) = 1 + 2a + b$$

$$\boxed{x = \frac{1 + 2a + b}{1 - 2a - b}}$$

$$\frac{2\sin(x^2 - 1) + a}{b - 1} + c_o = 2$$

$$2\sin(x^2 - 1) + a = (2 - c_o)(b - 1)$$

$$\sin(x^2 - 1) = \frac{(2 - c_o)(b-1) - a}{2}$$

$$x^2 - 1 = \sin^{-1}\left(\frac{(2 - c_o)(b-1) - a}{2}\right)$$

$$\boxed{x = \sqrt{\sin^{-1}\left(\frac{(2 - c_o)(b-1) - a}{2}\right) + 1}}$$

(4 marks) Solve for x and y in the following equation.

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

$$\frac{y + 1}{x + 1} = 2 \qquad (2)$$

simplify (1)

$$2x + 1 = -2(x + y)$$

$$2x + 1 = -2x - 2y$$

$$4x + 2y = -1 \qquad (1a)$$

simplify (2)

$$y + 1 = 2(x + 1)$$

$$y + 1 = 2x + 2$$

$$-2x + y = 1 \qquad (2a)$$

solve for y in (2a):

$$y = 1 + 2x \qquad (2b)$$

sub (2b) into (1a):

$$4x + 2[1 + 2x] = -1$$

$$4x + 2 + 4x = -1$$

$$8x = -3$$

$$\boxed{x = -\frac{3}{8} = -0.375} \qquad (1b)$$

sub (1b) into (2b)

$$y = 1 + 2\left[-\frac{3}{8}\right]$$

$$\boxed{y = \frac{1}{4} = 0.25}$$