Instructor:	Frank Secretain
Course:	Math 1004
Date:	December 9, 2025
Assessment:	Test 4a
Time allowed:	110 minutes
Devices allowed:	Pencil, pen, eraser, calculator
Notes from instructor:	Be neat. Show your work where needed. Box final answers.
Marks allocated:	5 questions worth 20 marks
Percentage of final grade:	20% of final grade

Formula Sheet

Order of Operations

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

exponents

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

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

$$(ab)^n = a^n b^n$$

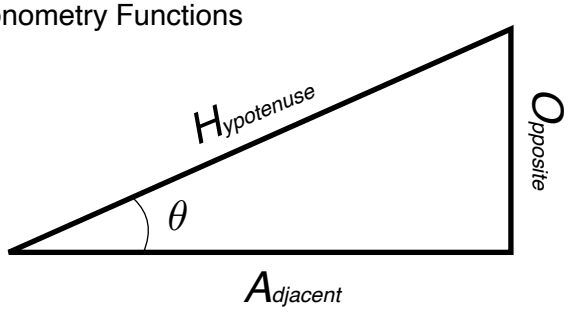
$$a^0 = 1$$

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

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.

$(272.4)(0.0032) + 3.1$ (4 sig figs, 2 sig figs)

$= 0.87168 + 3.1$ (0.87168: 2 sig figs, +2; 3.1: +1)

$= 3.97168$ (3.97168: +1)

$= 4.0$

$(2.43)(3839.506) + 670$ (3 sig figs, 7 sig figs)

$= 9329.99958 + 670$ (9329.99958: 3 sig figs, −1; 670: −1)

$= 9999.99958$ (9999.99958: −1)

$= 1.000 \times 10^4$

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

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

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

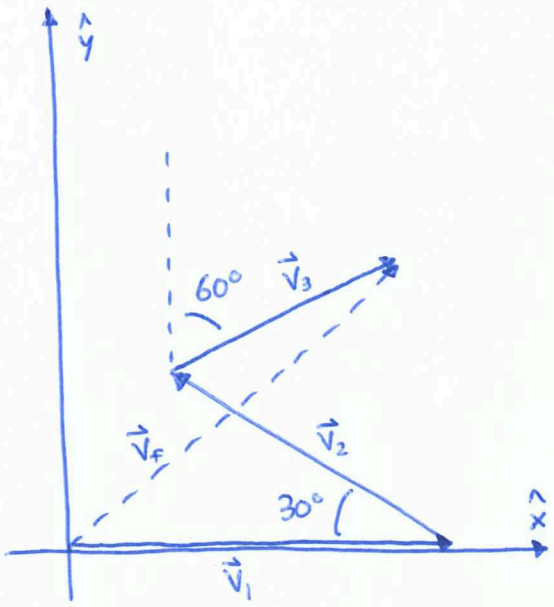
$$2.3 \ \frac{gal^2}{hour} \rightarrow \frac{L^2}{second}$$

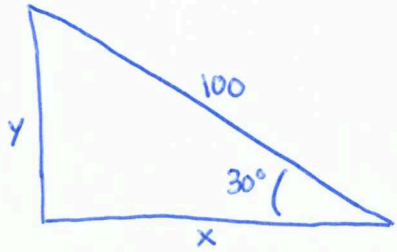
$$2.3 \ \frac{\cancel{gal^2}}{\cancel{hour}} \left(\frac{3.78 L}{1 \ \cancel{gal}}\right)\left(\frac{3.78 L}{1 \ \cancel{gal}}\right)\left(\frac{1 \ \cancel{hour}}{60 \ \cancel{min}}\right)\left(\frac{1 \ \cancel{min}}{60 \text{ sec}}\right)$$

$= 0.00913 \ L^2/sec$

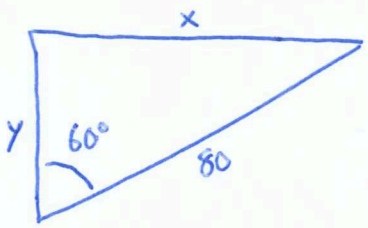
$= 9.13 \times 10^{-3} \ L^2/sec$

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





$x = 100\cos(30)$
$= 86.60$
$y = 100\sin(30)$
$= 50$



$x = 80\sin(60)$
$= 69.28$
$y = 80\cos(60)$
$= 40$

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

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

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

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

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

$$= 136.54$$

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

(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):

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

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

$8x = -3$

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

sub (1b) into (2b)

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

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

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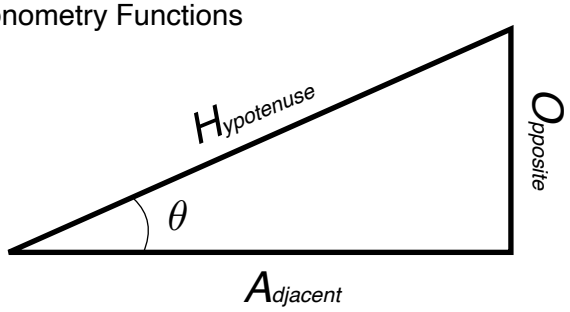
Trigonometry Functions



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Pythagoras Theorem

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

Relative Velocity

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

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

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

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

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

Quadratic Equation

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

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$$1\,\text{m} = 3.3\,\text{ft}$$

volumes

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

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

(222.4)(0.0032) + 3.1

(2.43)(38395.062)+6700

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

$$478\ \frac{km}{hour} \rightarrow\ \frac{miles}{day}$$

$$4.8\frac{L^2}{hour} \rightarrow \frac{gal^2}{second}$$

(4 marks) You run 110 m East, 130 m at 30^0 North of West and 80 m at 50^0 East of North. How far are you from where you started?

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

$$4x - \frac{4}{3}w^2 + \gamma_o = bx - 1$$

$$\frac{ax - c}{4} - 2(b - x) = 1$$

$$\frac{x+1}{x-1} - 3b = a$$

$$\frac{3\cos(x^2+2)+b}{a-1} + b_o = 3$$

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

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

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

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

$(222.4)(0.0032) + 3.1$ (4 sig figs; 2 sig figs; +1 decimal place)

$= 0.71168 + 3.1$ (+2 decimal places; +1 decimal place)

$= 3.81168$ (+1 decimal place)

$= 3.8$

$(2.43)(38395.062) + 6700$ (3 sig figs; 8 sig figs; -2 decimal places)

$= 93300.00066 + 6700$ (3 sig figs; -2 decimal places)

$= 100000.0007$ (-2 decimal places)

$= 1.000 \times 10^5$

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

$$478 \frac{km}{hour} \rightarrow \frac{miles}{day}$$

$$478 \frac{km}{hour}\left(\frac{1 \text{ mile}}{1.6 \text{ km}}\right)\left(\frac{24 \text{ hour}}{1 \text{ day}}\right) = 7170 \frac{\text{miles}}{\text{day}}$$

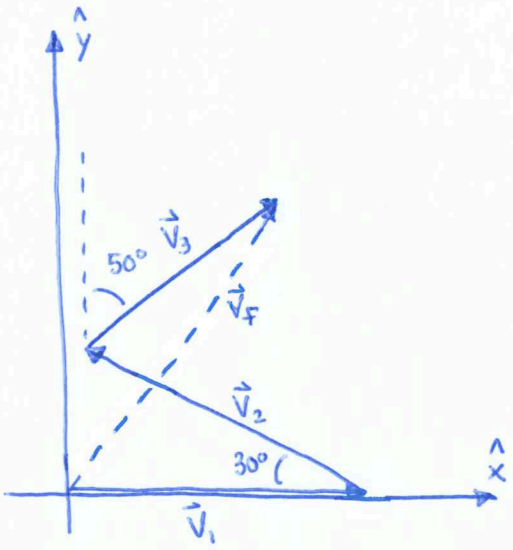
$$4.8 \frac{L^2}{hour} \rightarrow \frac{gal^2}{second}$$

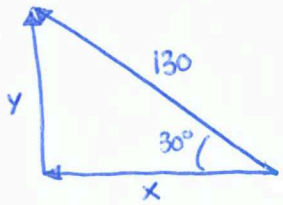
$$4.8 \frac{L^2}{\text{hour}}\left(\frac{1 \text{ gal}}{3.78 \text{ L}}\right)\left(\frac{1 \text{ gal}}{3.78 \text{ L}}\right)\left(\frac{1 \text{ hour}}{60 \text{ min}}\right)\left(\frac{1 \text{ min}}{60 \text{ sec}}\right)$$

$= 0.0000933 \frac{gal^2}{sec}$

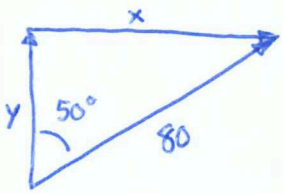
$= 9.33 \times 10^{-5} \frac{gal^2}{sec}$

(4 marks) You run 110 m East, 130 m at 30º North of West and 80 m at 50º East of North. How far are you from where you started?





$x = 130\cos(30)$
$= 112.58$
$y = 130\sin(30)$
$= 65$



$x = 80\sin(50)$
$= 61.28$
$y = 80\cos(50)$
$= 51.42$

$\vec{V}_1 = 110\,\hat{x} + 0\,\hat{y}$

$\vec{V}_2 = -112.58\,\hat{x} + 65\,\hat{y}$

$+\ \vec{V}_3 = 61.28\,\hat{x} + 51.42\,\hat{y}$

$\vec{V}_F = 58.7\,\hat{x} + 116.42\,\hat{y}$

$|\vec{V}_F| = \sqrt{(58.7)^2 + (116.42)^2}$

$= 130.4$

$\boxed{|\vec{V}_F| = 130.4 \text{ m}}$

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

$$4x - \frac{4}{3}w^2 + \gamma_o = bx - 1$$

$4x - bx = \frac{4}{3}w^2 - \gamma_o - 1$

$x(4-b) = \frac{4}{3}w^2 - \gamma_o - 1$

$$x = \frac{\frac{4}{3}w^2 - \gamma_o - 1}{4 - b} = \frac{4w^2 - 3\gamma_o - 3}{12 - 3b}$$

$$\frac{ax - c}{4} - 2(b - x) = 1$$

$\frac{a}{4}x - \frac{c}{4} - 2b + 2x = 1$

$\frac{a}{4}x + 2x = 1 + \frac{c}{4} + 2b$

$x\left(\frac{a}{4} + 2\right) = 1 + \frac{c}{4} + 2b$

$$x = \frac{1 + \frac{c}{4} + 2b}{\frac{a}{4} + 2} = \frac{4 + c + 8b}{a + 8}$$

$$\frac{x+1}{x-1} - 3b = a$$

$$x + 1 - 3b(x-1) = a(x-1)$$

$$x + 1 - 3bx + 3b = ax - a$$

$$x - 3bx - ax = -1 - 3b - a$$

$$x(1 - 3b - a) = -1 - 3b - a$$

$$x = \frac{-1 - 3b - a}{1 - 3b - a}$$

$$\frac{3\cos(x^2+2)+b}{a-1} + b_o = 3$$

$$3\cos(x^2+2) + b = (3 - b_o)(a-1)$$

$$\cos(x^2+2) = \frac{(3-b_o)(a-1) - b}{3}$$

$$x^2 + 2 = \cos^{-1}\left(\frac{(3-b_o)(a-1) - b}{3}\right)$$

$$x = \sqrt{\cos^{-1}\left(\frac{(3-b_o)(a-1) - b}{3}\right) - 2}$$

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

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

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

simplify (1):

$$3x+1=-(y-x)$$

$$3x+1=-y+x$$

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

simplify (2):

$$x+1=3(y+1)$$

$$x+1=3y+3$$

$$x-3y=2 \qquad (2a)$$

solve for x in (2a):

$$x=2+3y \qquad (2b)$$

sub (2b) into (1a):

$$2[2+3y]+y=-1$$

$$4+6y+y=-1$$

$$7y=-5$$

$$\boxed{y=-\frac{5}{7}=-0.7143} \qquad (1b)$$

sub (1b) into (2b):

$$x=2+3\left[-\frac{5}{7}\right]$$

$$\boxed{x=-\frac{1}{7}=-0.1429}$$