Instructor:	Frank Secretain
Course:	math 101
Assessment:	Test 1
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:	6 questions worth 25 marks
Percentage of final grade:	25% 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

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

Relative Velocity

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

Linear equations (Cramer's rule)

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

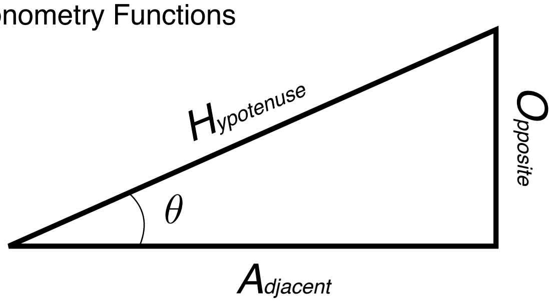
Forms of a 2nd order polynomial

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

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

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

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

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

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

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

(4 marks) Match the “type of number” with the best “example number”. Draw a line to match the “type of number” to the “example number” to indicate your answer.

natural	$2^{\frac{1}{2}}$
rational	2^2
imaginary	$(-2)^{\frac{1}{2}}$
irrational	$-(2^2)$

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

130+18.365

58.23+(0.010)(1002.3)

7239.1+(1.2)(2300.75)

(2 marks) Convert each of the numbers to the stated units.

$$103^o \rightarrow radians$$

$$9.23 \; \frac{inchs^2}{L} \rightarrow \frac{mm^2}{gallon}$$

(1 marks) Re-write the equation in computer syntax with the minimum number of characters, Do not simplify or rearrange the equation.

$$\frac{ax-b}{cd+1} - 1 = y$$

(5 marks) You run 30 m East, 20 m North, 40 m at 15^0 South of East and an “unknown distance and direction”. Your final position relative to your starting point is 10 m 20^0 East of North. How far did you run for the “unknown distance”?

(10 marks) Solve for x in the following equations

$$\frac{\Gamma^2(t-1)^a+1}{y-1} - bx + c = \Pi$$

$$\frac{y-1}{x-1} + 1 = b$$

$$\frac{\Gamma(ax+b)-c}{a+b}+1=\cot(r\theta)$$

$$1 + \frac{1}{4(x^2 - 1)} = \sin(\theta t + \phi)$$

(4 marks) Match the "type of number" with the best "example number". Draw a line to match the "type of number" to the "example number" to indicate your answer.

natural	$2^{\frac{1}{2}}$ = 1.41...
rational	2^2 = 4
imaginary	$(-2)^{\frac{1}{2}}$ = math error
irrational	$-(2^2)$ = - 4

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

130+18.365 = 148.365

= 150

58.23+(0.010)(1002.3) = 58.23 + 10.023

= 68.253

= 68

7239.1+(1.2)(2300.75) = 7239.1 + 2760.9

= 10000.

= 1.00×10^4

(2 marks) Convert each of the numbers to the stated units.

$$103^o \rightarrow radians$$

$$103^{\circ}\left(\frac{2\pi\ rad}{360^{\circ}}\right) = \boxed{1.8\ rads}$$

$$9.23\ \frac{inchs^2}{L} \rightarrow \frac{mm^2}{gallon}$$

$$9.23\ \frac{inchs^2}{L}\left(\frac{3.78\ L}{1\ gallon}\right)\left(\frac{2.54^2\ cm^2}{1^2\ inch^2}\right)\left(\frac{10^2\ mm^2}{1^2\ cm^2}\right) = \boxed{22500\ \frac{mm^2}{gallon}}$$

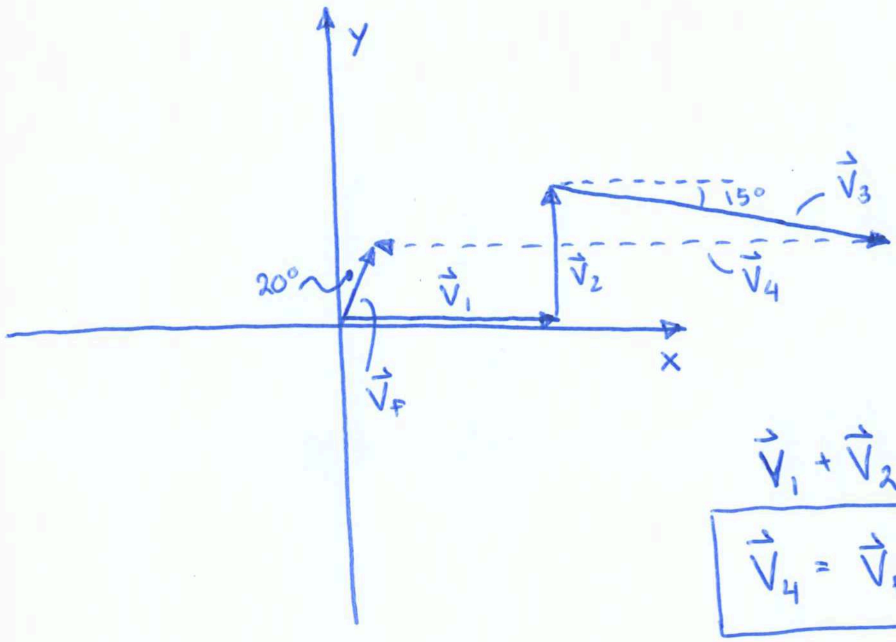
9.23 * 3.78 * 2.54 ^ 2 * 10 ^ 2 = 22509.25

(1 marks) Re-write the equation in computer syntax with the minimum number of characters, Do not simplify or rearrange the equation.

$$\frac{ax-b}{cd+1} - 1 = y$$

(a*x - b) / (c*d + 1) - 1 = y

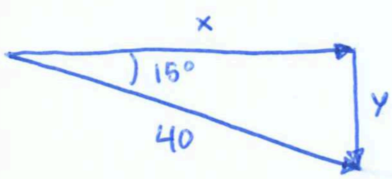
(5 marks) You run 30 m East, 20 m North, 40 m at 15^0 South of East and an “unknown distance and direction”. Your final position relative to your starting point is 10 m 20^0 East of North. How far did you run for the “unknown distance”?



$$\vec{V}_1 + \vec{V}_2 + \vec{V}_3 + \vec{V}_4 = \vec{V}_F$$

$$\boxed{\vec{V}_4 = \vec{V}_F - \vec{V}_1 - \vec{V}_2 - \vec{V}_3}$$

$\vec{V}_3$:



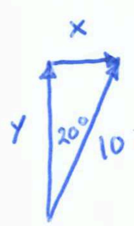
$x = 40 \cos(15°) = 38.64$

$y = 40 \sin(15°) = 10.35$

$$\vec{V}_F = 3.42\,\hat{x} + 9.397\,\hat{y}$$
$$-V_1 = -30\,\hat{x} + 0\,\hat{y}$$
$$-V_2 = 0\,\hat{x} - 20\,\hat{y}$$
$$-V_3 = -38.64\,\hat{x} + 10.35\,\hat{y}$$

$$\vec{V}_4 = -65.22\,\hat{x} - 0.253\,\hat{y}$$

$\vec{V}_F$:



$x = 10 \sin(20°) = 3.42$

$y = 10 \cos(20°) = 9.397$

$$|\vec{V}_4| = \sqrt{(-65.22)^2 + (-0.253)^2}$$

$$\boxed{|\vec{V}_4| = 65.2 \text{ m}}$$

(10 marks) Solve for x in the following equations

$$\frac{\Gamma^2(t-1)^a+1}{y-1} - bx + c = \Pi$$

$$\frac{\Gamma^2(t-1)^a+1}{y-1} + c - \Pi = bx$$

$$bx = \frac{\Gamma^2(t-1)^a+1}{y-1} + c - \Pi$$

$$\boxed{x = \frac{1}{b}\left[\frac{\Gamma^2(t-1)^a+1}{y-1} + c - \Pi\right]}$$

$$\frac{y-1}{x-1} + 1 = b$$

$$\frac{y-1}{x-1} = b-1$$

$$\frac{y-1}{b-1} = x-1$$

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

$$\frac{\Gamma(ax+b)-c}{a+b}+1=\cot(r\theta)$$

$$\frac{\Gamma(ax+b)-c}{a+b}=\cot(r\theta)-1$$

$$\Gamma(ax+b)-c=\left(\cot(r\theta)-1\right)(a+b)$$

$$\Gamma(ax+b)=\left(\cot(r\theta)-1\right)(a+b)+c$$

$$ax+b=\frac{1}{\Gamma}\left[\left(\cot(r\theta)-1\right)(a+b)+c\right]$$

$$ax=\frac{1}{\Gamma}\left[\left(\cot(r\theta)-1\right)(a+b)+c\right]-b$$

$$\boxed{x=\frac{1}{a}\left(\frac{1}{\Gamma}\left[\left(\cot(r\theta)-1\right)(a+b)+c\right]-b\right)}$$

$$1 + \frac{1}{4(x^2 - 1)} = \sin(\theta t + \phi)$$

$$\frac{1}{4(x^2 - 1)} = \sin(\theta t + \phi) - 1$$

$$\frac{1}{4(\sin(\theta t + \phi) - 1)} = x^2 - 1$$

$$x^2 = \frac{1}{4(\sin(\theta t + \phi) - 1)} + 1$$

$$\boxed{x = \sqrt{\frac{1}{4(\sin(\theta t + \phi) - 1)} + 1}}$$