Instructor:	Frank Secretain
Course:	Math 1004a
Date:	September 27, 2024
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:	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

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

Relative Velocity

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

Linear equations (Cramer's rule)

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

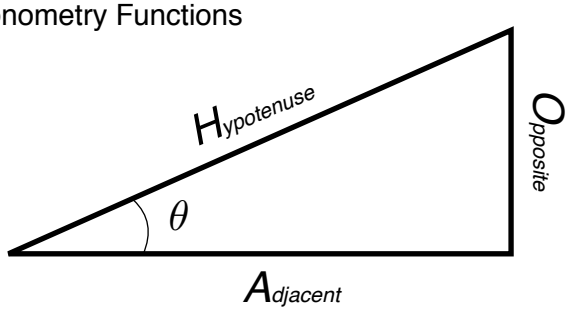
Forms of a 2nd order polynomial

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

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

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

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.

irrational	0
integer	$-\sqrt{1}$
rational	-2.1
whole	$\sqrt{3}$

(3 marks) Determine

a) the total number of significant digits and
b) the number of decimal places to the least significant digit
c) re-write the number in scientific notation

for the following number:

0.020310

a) significant digits = _____

b) decimal places = _____

c) scientific notation = _____

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

160+12.183

(13.0)(0.02310)

212.4+(290)(3.008492)

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

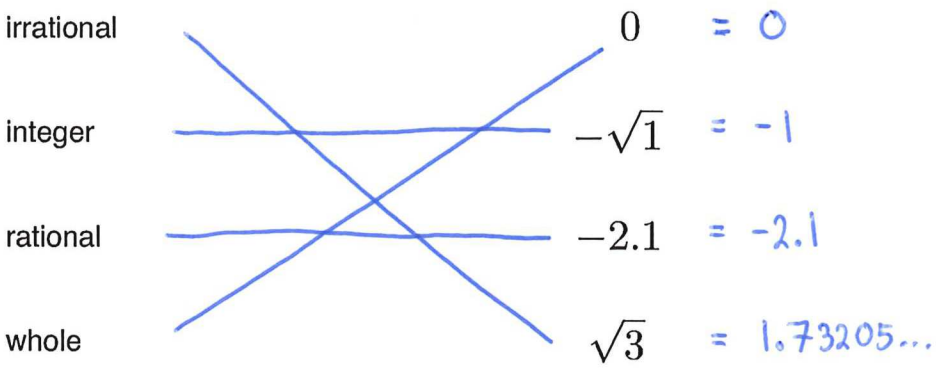
$$2.8 \text{ lbs.} \rightarrow \text{kg}$$

$$0.0452 \ \frac{\text{radians}}{\text{inch}} \rightarrow \frac{\text{degrees}}{\text{cm}}$$

$$0.00873 \ \frac{\text{gallon}^2}{\text{minute}} \rightarrow \frac{\text{Litres}^2}{\text{day}}$$

(5 marks) You run 730 m East, 250 South and 120 m at 50^0 West of North. How far are you from where you started?

(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.



(3 marks) Determine

a) the total number of significant digits and
b) the number of decimal places to the least significant digit
c) re-write the number in scientific notation

for the following number:

0.020310 → 5

+6

a) significant digits = 5

b) decimal places = +6

c) scientific notation = 2.0310×10^{-2}

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

160 + 12.183 = 172.183 = 170

−1 +3 −1

(13.0)(0.02310) = 0.3003 = 0.300

3 4

$212.4+\underset{2}{(290)}\underset{7}{(3.008492)} = 212.4 + 872.46268$

$= 1084.86268 = \boxed{1080}$

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

$2.8 \text{ lbs.} \rightarrow \text{kg}$

$2.8 \text{ lbs.} \left(\frac{1 \text{ kg}}{2.2 \text{ lbs.}}\right) = 1.\overline{27} \text{ kg} = \boxed{1.3 \text{ kg}}$

$0.0452 \dfrac{\text{radians}}{\text{inch}} \rightarrow \dfrac{\text{degrees}}{\text{cm}}$

$0.0452 \dfrac{\text{rads}}{\text{inch}} \left(\dfrac{360^\circ}{2\pi \text{ rads}}\right)\left(\dfrac{1 \text{ inch}}{2.54 \text{ cm}}\right) = 1.0196 \dfrac{\text{degrees}}{\text{cm}}$

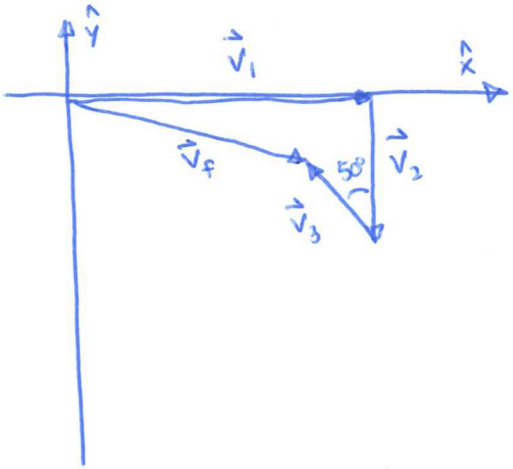
$= \boxed{1.02 \dfrac{\text{degrees}}{\text{cm}}}$

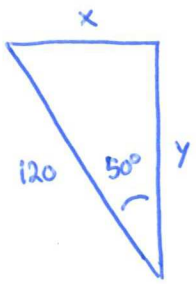
$0.00873 \dfrac{\text{gallon}^2}{\text{minute}} \rightarrow \dfrac{\text{Litres}^2}{\text{day}}$

$0.00873 \dfrac{\text{gallon}^2}{\text{minute}} \left(\dfrac{3.78 \text{ L}}{1 \text{ gal}}\right)\left(\dfrac{3.78 \text{ L}}{1 \text{ gal}}\right)\left(\dfrac{60 \text{ min}}{1 \text{ hour}}\right)\left(\dfrac{24 \text{ hour}}{1 \text{ day}}\right)$

$= 179.62 \dfrac{\text{L}^2}{\text{day}} = \boxed{1.80 \times 10^2 \dfrac{\text{L}^2}{\text{day}}}$

(5 marks) You run 730 m East, 250 South and 120 m at 50º West of North. How far are you from where you started?





$x = 120 \sin(50) = 91.9253$

$y = 120 \cos(50) = 77.1345$

$\vec{V}_1 = 730\,\hat{x} + 0\,\hat{y}$

$\vec{V}_2 = 0\,\hat{x} - 250\,\hat{y}$

$\vec{V}_3 = -91.9253\,\hat{x} + 77.1345\,\hat{y}$

$\vec{V}_f = 638.0747\,\hat{x} - 172.8655\,\hat{y}$

$|\vec{V}_f| = \sqrt{(638.0747)^2 + (-172.8655)^2}$

$= 661.0762$

$\boxed{|\vec{V}_f| = 660 \text{ m}}$

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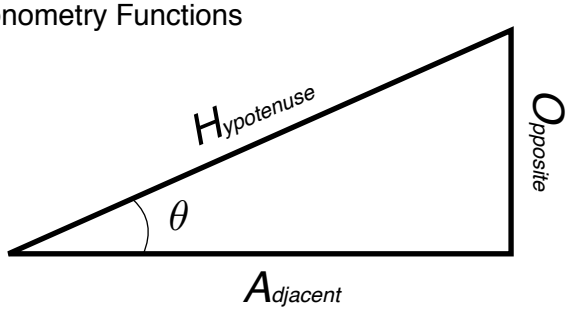

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volumes

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

(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.

irrational	$\sqrt{1}$
integer	$\sqrt{-1}$
rational	$\sqrt{5}$
imaginary	-5.2

(3 marks) Determine

a) the total number of significant digits and
b) the number of decimal places to the least significant digit
c) re-write the number in scientific notation

for the following number:

0.010130

a) significant digits = _____

b) decimal places = _____

c) scientific notation = _____

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

130+16.129

(11.0)(0.03840)

223.4+(270)(4.00862)

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

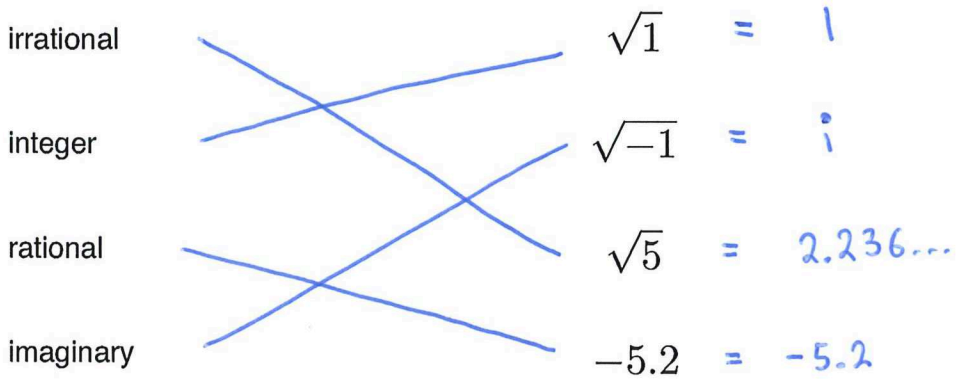
$$4.8 \text{ kg} \rightarrow \text{lbs.}$$

$$4.8 \frac{\text{inch}}{\text{degree}} \rightarrow \frac{\text{cm}}{\text{radians}}$$

$$5.82 \frac{\text{Litres}^2}{\text{day}} \rightarrow \frac{\text{gallon}^2}{\text{minute}}$$

(5 marks) You run 470 m East, 230 South and 180 m at 40^0 West of North. How far are you from where you started?

(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.



(3 marks) Determine

a) the total number of significant digits and
b) the number of decimal places to the least significant digit
c) re-write the number in scientific notation

for the following number:

0.010130

a) significant digits = 5

b) decimal places = +6

c) scientific notation = 1.0130×10^{-2}

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

130+16.129 = 146.129 = 150

(11.0)(0.03840) = 0.4224 = 0.422

$223.4+\underbrace{(270)}_{2}\underbrace{(4.00862)}_{6} = \underbrace{223.4}_{+1} + \underbrace{1082.3274}_{-2}$

$= \underbrace{1305.7274}_{-2}$

$= \boxed{1300}$

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

$4.8 \text{ kg} \rightarrow \text{lbs.}$

$4.8 \cancel{\text{kg}} \left(\frac{2.2 \text{ lbs}}{1 \cancel{\text{kg}}}\right) = 10.56 \text{ lbs.} = \boxed{11 \text{ lbs.}}$

$4.8 \dfrac{\text{inch}}{\text{degree}} \rightarrow \dfrac{\text{cm}}{\text{radians}}$

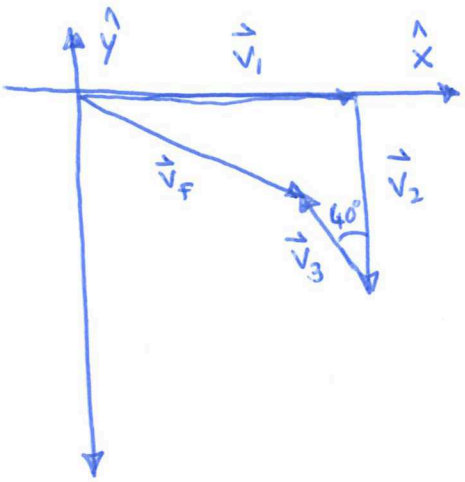
$4.8 \dfrac{\cancel{\text{inch}}}{\cancel{\text{deg.}}} \left(\dfrac{2.54 \text{ cm}}{1 \cancel{\text{inch}}}\right)\left(\dfrac{360^\circ}{2\pi \text{ rad}}\right) = 698.55 \dfrac{\text{cm}}{\text{rad}} = \boxed{7.0 \times 10^2 \dfrac{\text{cm}}{\text{rad}}}$

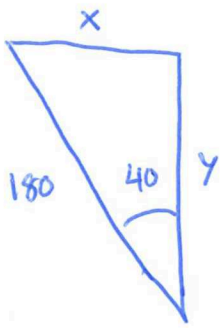
$5.82 \dfrac{\text{Litres}^2}{\text{day}} \rightarrow \dfrac{\text{gallon}^2}{\text{minute}}$

$5.82 \dfrac{\text{L}^2}{\cancel{\text{day}}} \left(\dfrac{1 \text{ gal}}{3.78 \cancel{\text{L}}}\right)\left(\dfrac{1 \text{ gal}}{3.78 \cancel{\text{L}}}\right)\left(\dfrac{1 \cancel{\text{day}}}{24 \cancel{\text{hour}}}\right)\left(\dfrac{1 \cancel{\text{hour}}}{60 \text{ min}}\right) = 0.0002829 \dfrac{\text{gal}^2}{\text{min}}$

$= \boxed{0.000283 \dfrac{\text{gal}^2}{\text{min}}}$

(5 marks) You run 470 m East, 230 South and 180 m at 40º West of North. How far are you from where you started?





$x = 180 \sin(40) = 115.70$

$y = 180 \cos(40) = 137.89$

$\vec{V}_1 = 470\,\hat{x} + 0\,\hat{y}$

$\vec{V}_2 = 0\,\hat{x} - 230\,\hat{y}$

$\vec{V}_3 = -115.70\,\hat{x} + 137.89\,\hat{y}$

$\vec{V}_F = 354.3\,\hat{x} - 92.11\,\hat{y}$

$|\vec{V}_F| = \sqrt{(354.3)^2 + (-92.11)^2}$

$= 366.078$

$\boxed{|\vec{V}_F| = 370 \text{ m}}$