

Instructor: Frank Secretain
Course: Civil 32
Date: October 22, 2026

Assessment: Test 1 (practice)
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

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

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

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

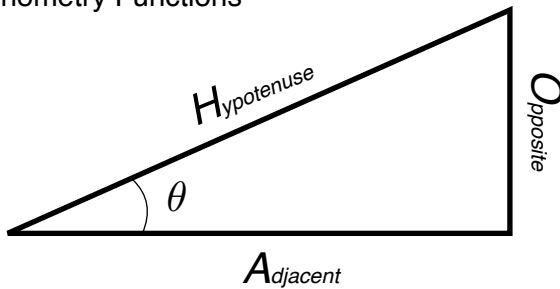
$$a^0 = 1$$

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

radicals

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

Trigonometry Functions



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

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

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

Pythagoras Theorem

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

Relative Velocity

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

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

Kinematics

$$\vec{x} = \vec{x}_o + \vec{v}_o t + \frac{1}{2} \vec{a} t^2$$

$$\vec{v}^2 = \vec{v}_o^2 + 2\vec{a}(\vec{x} - \vec{x}_o)$$

$$\vec{v} = \vec{v}_o + \vec{a} t$$

Line equation

$$y = ax + b$$

Quadratic Equation

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

Unit Conversions

angles

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

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

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

(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:

0.01010

a) significant digits = _____

b) decimal places = _____

c) scientific notation = _____

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

$$2400+128.183$$

$$(10.0)(0.72310)$$

$$239.76+(6810)(1.72691)$$

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

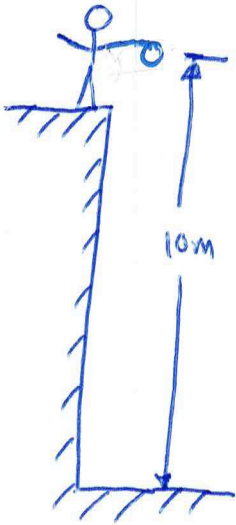
$$5.2 \frac{\text{lbs.}}{\text{minute}} \rightarrow \frac{\text{kg}}{\text{second}}$$

$$0.0134 \frac{\text{degrees}}{\text{second}} \rightarrow \frac{\text{radians}}{\text{hour}}$$

$$0.0134 \frac{\text{gallon}^2}{\text{meter}} \rightarrow \frac{\text{litres}^2}{\text{inch}}$$

(5 marks) You run 810 m East, 250 m at 35° North of East and 220 m at 40° West of North. How far are you from where you started?

(5 marks) If you drop a ball from 10 m off the ground, how long will it take to hit the ground.



(3 marks) Determine

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

for the following number:

$$\begin{array}{c} 0.01010 \\ \hline +5 \end{array}$$

a) significant digits = 4

b) decimal places = +5

c) scientific notation = 1.010×10^{-2}

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

$$\begin{array}{c} 2400 \\ \hline -2 \end{array} + \begin{array}{c} 128.183 \\ \hline +3 \end{array} = \begin{array}{c} 2528.183 \\ \hline -2 \end{array} = \boxed{2500}$$

$$\begin{array}{c} (10.0) \\ \hline 3 \end{array} \begin{array}{c} (0.72310) \\ \hline 5 \end{array} = \begin{array}{c} 7.231 \\ \hline 6 \end{array} = \boxed{7.23}$$

$$239.76 + \begin{array}{c} (6810) \\ \hline 3 \end{array} \begin{array}{c} (1.72691) \\ \hline 6 \end{array}$$

$$\begin{array}{c} 239.76 \\ \hline +2 \end{array} + \begin{array}{c} 11760.2571 \\ \hline -2 \end{array} = \begin{array}{c} 12000.0171 \\ \hline -2 \end{array} = \boxed{1.20 \times 10^4}$$

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

$$5.2 \frac{\text{lbs.}}{\text{minute}} \rightarrow \frac{\text{kg}}{\text{second}}$$

$$5.2 \frac{\cancel{\text{lbs}}}{\cancel{\text{min}}} \left(\frac{1 \text{ kg}}{2.2 \cancel{\text{lbs}}} \right) \left(\frac{1 \cancel{\text{min}}}{60 \text{ sec}} \right) = \boxed{0.039 \frac{\text{kg}}{\text{sec}}}$$

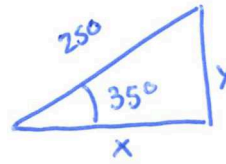
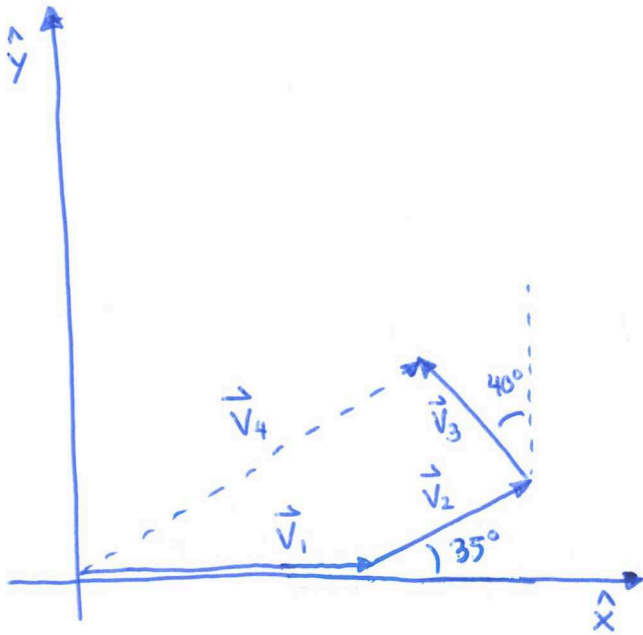
$$0.0134 \frac{\text{degrees}}{\text{second}} \rightarrow \frac{\text{radians}}{\text{hour}}$$

$$0.0134 \frac{\cancel{\text{deg}}}{\cancel{\text{sec}}} \left(\frac{2\pi \text{ rad}}{360 \cancel{\text{deg}}} \right) \left(\frac{60 \cancel{\text{sec}}}{1 \cancel{\text{min}}} \right) \left(\frac{60 \cancel{\text{min}}}{1 \text{ hour}} \right) = \boxed{0.842 \frac{\text{rad}}{\text{hour}}}$$

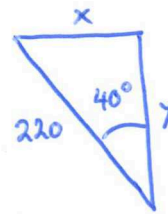
$$0.0134 \frac{\text{gallon}^2}{\text{meter}} \rightarrow \frac{\text{litres}^2}{\text{inch}}$$

$$0.0134 \frac{\cancel{\text{gallon}^2}}{\cancel{\text{meter}}} \left(\frac{3.78 \text{ L}}{1 \cancel{\text{gal}}} \right) \left(\frac{3.78 \text{ L}}{1 \cancel{\text{gal}}} \right) \left(\frac{1 \cancel{\text{m}}}{100 \cancel{\text{cm}}} \right) \left(\frac{2.54 \cancel{\text{cm}}}{1 \text{ inch}} \right) = \boxed{0.00486 \frac{\text{L}^2}{\text{inch}}}$$

(5 marks) You run 810 m East, 250 m at 35° North of East and 220 m at 40° West of North. How far are you from where you started?



$$\begin{aligned} x &= 250 \cos(35) \\ &= 204.8 \\ y &= 250 \sin(35) \\ &= 143.4 \end{aligned}$$



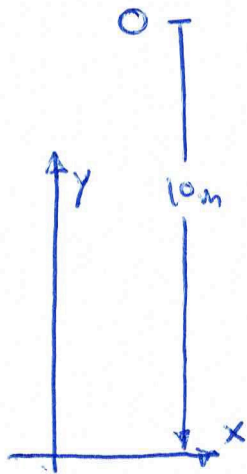
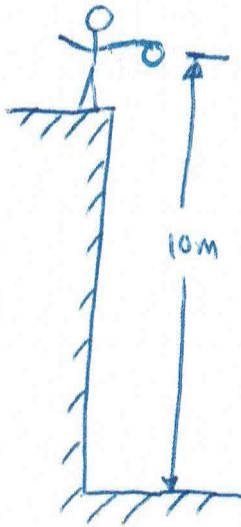
$$\begin{aligned} x &= 220 \sin(40) \\ &= 141.4 \\ y &= 220 \cos(40) \\ &= 168.5 \end{aligned}$$

$$\begin{aligned} \vec{V}_1 &= 810 \hat{x} + 0 \hat{y} \\ \vec{V}_2 &= 204.8 \hat{x} + 143.4 \hat{y} \\ + \vec{V}_3 &= -141.4 \hat{x} + 168.5 \hat{y} \\ \hline \vec{V}_F &= 873.4 \hat{x} + 311.9 \hat{y} \end{aligned}$$

$$\begin{aligned} |\vec{V}_F| &= \sqrt{(873.4)^2 + (311.9)^2} \\ &= 927.4 \end{aligned}$$

$|\vec{V}_F| = 930 \text{ m}$

(5 marks) If you drop a ball from 10 m off the ground, how long will it take to hit the ground.



y-dir:

$$y_0 = 10 \text{ m}$$

$$y_f = 0$$

$$v_{y0} = 0$$

$$\underline{v_{yf}} =$$

$$a_y = -9.81 \text{ m/s}^2$$

time:

$$\underline{t =}$$

Kinematic equation in y-direction:

$$y = y_0 + v_{oy} \underline{t} + \frac{1}{2} a_y \underline{t}^2 \quad (1)$$

$$\underline{v_y}^2 = v_{oy}^2 + 2a_y(y - y_0) \quad (2)$$

$$\underline{v_y} = v_{oy} + a_y \underline{t} \quad (3)$$

Solve (2) for v_{yf} :

$$v_{yf}^2 = v_{oy}^2 + 2a_y(y_f - y_0)$$

$$v_{yf} = \pm \sqrt{v_{oy}^2 + 2a_y(y_f - y_0)}$$

$$= \pm \sqrt{0^2 + 2(-9.81)(0 - 10)}$$

$$\boxed{v_{yf} = \pm 14.0 \text{ m/s} = -14 \text{ m/s}}$$

Solve (3) for t :

$$v_{fy} = v_{oy} + a_y t$$

$$v_{fy} - v_{oy} = a_y t$$

$$a_y t = v_{fy} - v_{oy}$$

$$t = \frac{v_{fy} - v_{oy}}{a_y}$$

$$= \frac{-14 - 0}{-9.81}$$

$$= 1.43 \text{ s}$$

$$\boxed{t = 1.4 \text{ s}}$$