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| Instructor: | Frank Secretain |
| Course: | Math 101 |
| Assessment: | Final Test |
| Time allowed: | 110 minutes |
| Devices allowed: | Pencil, pen, eraser, calculator |
| Marks allocated: | 5 questions worth 25 marks |
| Percentage of final grade: | 20% of final grade |
| Notes from instructor: | Be neat. Show your work where needed. Box final answers.<br>Print your test and write answers in the space provided.<br>If you can't print, then use blank paper and copy the question number as it is written on the test and answer in the space provided as if the test was printed. |
| Questions: | Give me a call on teams. |
| Submission: | At the end of your test: scan or take pictures of your test pages in order. Compile email and send it to:<br><br>**math101@franksecretain.ca**<br>**by 2:30 pm on December 17, 2020** |

# Formula Sheet

## Order of Operations

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

### exponents

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

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

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

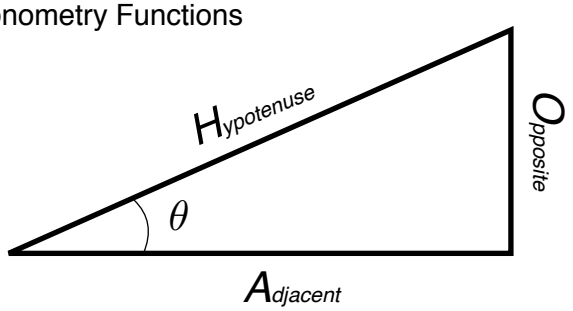
$$a^0 = 1$$

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

### 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

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

## 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

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

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

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

## 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.

14.5 + 0.12 / 0.0053

1901 + 0.01/0.0001

let:

$$15.6\tau = \Lambda \qquad 4.6\gamma = 3.1\beta$$

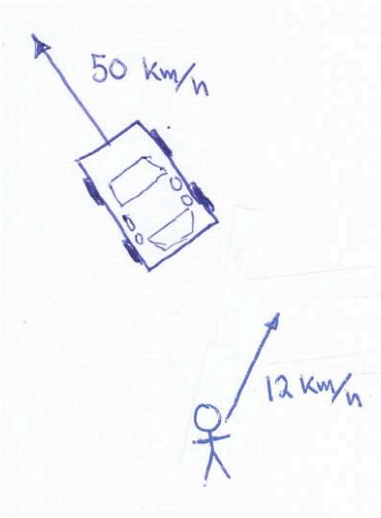
$$0.087\epsilon = 2.3\Lambda \qquad 3.1\theta = 2.1\Phi$$

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

$$3.0\ \frac{\Lambda}{\Phi} \rightarrow \frac{\epsilon}{\Phi}$$

$$1.2\ \frac{\tau^2}{m\theta} \rightarrow \frac{\Lambda^2}{\Phi}$$

(5 marks) A car is driving at 50 km/h at 45 degrees West of North relative to the ground and you are running at 12 km/h at 60 degree North of East relate to the ground. How fast is the car driving away relative to you.



(9 marks) Solve for a in the expressions:

$$\frac{b-4}{a-2} = \eta_o + b$$

$$\frac{7a - b(a+2)}{2} - 1 = a$$

$$\frac{1}{a} + \frac{2(a-1)}{7a} = 2$$

$$\frac{2\sin(4a+b)}{b+2} = 7$$

(5 marks) You bought 8 apples, 2 bananas and 10 carrots and paid $35. From that you returned 2 apples, 2 bananas and 2 carrots which gave you $10. You still needed more money so you returned 1 apple and 3 carrots which gave you $5. How much was the apple?

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

$14.5 + 0.12 / 0.0053 = 14.5 + 22.6415$ (+1, 0)

$= 37.1415$ (0)

$\boxed{= 37}$

$1901 + 0.01/0.0001 = 1901. + 100$ (0, −2)

$= 2001$ (−2)

$\boxed{= 2.0 \times 10^3}$

let:

$$15.6\tau = \Lambda \qquad 4.6\gamma = 3.1\beta$$

$$0.087\epsilon = 2.3\Lambda \qquad 3.1\theta = 2.1\Phi$$

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

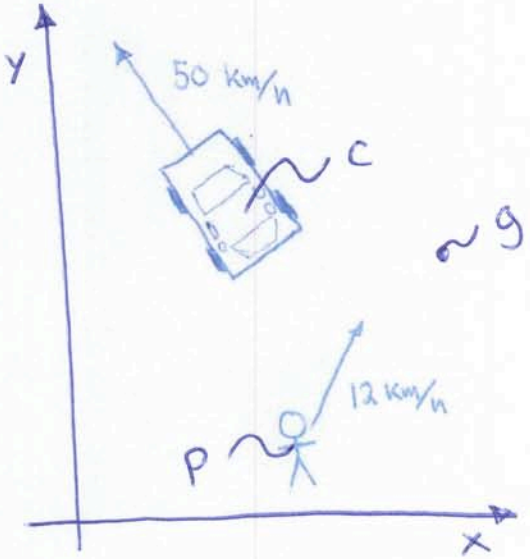
$$3.0\ \frac{\Lambda}{\Phi} \rightarrow \frac{\epsilon}{\Phi}$$

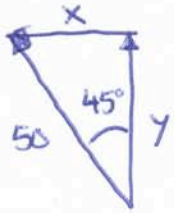
$$3.0 \frac{\cancel{\Lambda}}{\Phi}\left(\frac{0.087\epsilon}{2.3\cancel{\Lambda}}\right) \quad \boxed{= 0.11 \frac{\epsilon}{\Phi}}$$

$$1.2\ \frac{\tau^2}{m\theta} \rightarrow \frac{\Lambda^2}{\Phi}$$

$$1.2 \frac{\cancel{\tau^2}}{\cancel{m\theta}}\left(\frac{\Lambda}{15.6\cancel{\tau}}\right)^2\left(\frac{1000\ \cancel{m}\theta}{\cancel{\theta}}\right)\left(\frac{3.1\cancel{\theta}}{2.1\Phi}\right) \quad \boxed{= 7.3 \frac{\Lambda^2}{\Phi}}$$

(5 marks) A car is driving at 50 km/h at 45 degrees West of North relative to the ground and you are running at 12 km/h at 60 degree North of East relate to the ground. How fast is the car driving away relative to you.




$x = 50 \sin(45) = 35.4$

$y = 50 \cos(45) = 35.4$


$x = 12 \cos(60) = 6$

$y = 12 \sin(60) = 10.4$

$$\vec{V}_{c/p} = \vec{V}_{c/g} + \vec{V}_{g/p}$$

$$V_{g/p} = -V_{p/g}$$

$$\vec{V}_{c/g} = -35.4\,\hat{x} + 35.4\,\hat{y}$$

$$-V_{p/g} = -6\,\hat{x} - 10.4\,\hat{y}$$

$$V_{c/p} = -41.4\,\hat{x} + 25.0\,\hat{y}$$

$$|\vec{V}_{c/p}| = \sqrt{(-41.4)^2 + (25.0)^2} = 48.3 \text{ km/h}$$

$$\boxed{|\vec{V}_{c/p}| = 48 \text{ km/h}}$$

(9 marks) Solve for a in the expressions:

$$(a-2)\left(\frac{b-4}{a-2}\right)=\left(\eta_o+b\right)(a-2)$$

$$b-4 = m_o(a-2) + b(a-2)$$

$$b-4 = m_o a - 2m_o + ba - 2b$$

$$m_o a + ba = b - 4 + 2m_o + 2b$$

$$a(m_o + b) = 2m_o + 3b - 4$$

$$\boxed{a = \frac{2m_o + 3b - 4}{m_o + b}}$$

$$2\left(\frac{7a-b(a+2)}{2}-1\right)=\left(a\right)2$$

$$7a - ba - 2b - 2 = 2a$$

$$7a - ba - 2a = 2 + 2b$$

$$a(5 - b) = 2 + 2b$$

$$\boxed{a = \frac{2 + 2b}{5 - b}}$$

$$7a\left(\frac{1}{a}+\frac{2(a-1)}{7a}\right)=\left(2\right)7a$$

$$7 + 2a - 2 = 14a$$

$$12a = 5$$

$$\boxed{a = \frac{5}{12}}$$

$$(b+2)\left(\frac{2\sin(4a+b)}{b+2}\right)=\left(7\right)(b+2)$$

$$2\sin(4a+b) = 7b + 14$$

$$\sin(4a+b) = \frac{7b+14}{2}$$

$$4a + b = \sin^{-1}\left(\frac{7b+14}{2}\right)$$

$$4a = \sin^{-1}\left(\frac{7b+14}{2}\right) - b$$

$$\boxed{a = \frac{1}{4}\sin^{-1}\left(\frac{7b+14}{2}\right) - \frac{b}{4}}$$

(5 marks) You bought 8 apples, 2 bananas and 10 carrots and paid $35. From that you returned 2 apples, 2 bananas and 2 carrots which gave you $10. You still needed more money so you returned 1 apple and 3 carrots which gave you $5. How much was the apple?

let:

$a$ = price of an apple

$b$ = price of a banana

$c$ = price of a carrot.

so

$$8a + 2b + 10c = 35 \quad (1)$$

$$2a + 2b + 2c = 10 \quad (2)$$

$$a + 3c = 5 \quad (3)$$

solve for $a$ in (3)

$$a = 5 - 3c \quad (3a)$$

sub (3a) into (1)

$$8[5-3c] + 2b + 10c = 35$$

$$40 - 24c + 2b + 10c = 35$$

$$2b - 14c = -5 \quad (1a)$$

sub (3a) into (2)

$$2[5-3c] + 2b + 2c = 10$$

$$10 - 6c + 2b + 2c = 10$$

$$2b - 4c = 0 \quad (2a)$$

solve for $b$ in (2a)

$$2b = 4c$$

$$\boxed{b = 2c} \quad (2b)$$

sub (2b) into (1a)

$$2[2c] - 14c = -5$$

$$-10c = -5$$

$$\boxed{c = \frac{1}{2} = 0.50}$$

sub into (2b)

$$\boxed{b = 2\left[\tfrac{1}{2}\right] = 1}$$

sub into (3a)

$$a = 5 - 3\left[\tfrac{1}{2}\right]$$

$$\boxed{a = 3.50}$$