Instructor: Frank Secretain
Course: Math 101
Date: November 26, 2025

Assessment: Test 3
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: 3 questions worth 20 marks
Percentage of final grade: 20% of final grade

Formula Sheet

Order of Operations

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

exponents

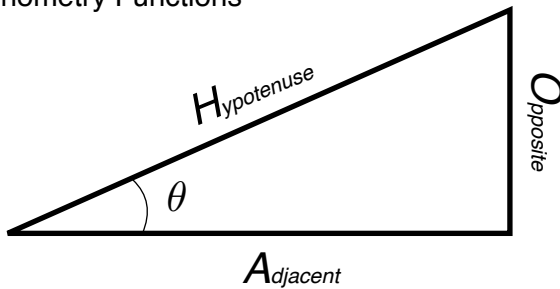$$a^n a^m = a^{n+m}$$

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

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

$$a^0 = 1$$

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

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

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

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

$$3b(3ax - b) + \frac{4x}{3} = 2$$

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

$$2 + \frac{\sin(3 - x^2) + b^2}{b - 1} - \beta^2 = 0$$

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

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

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

$$1 - \frac{y}{x - 1} + 1 = 0$$

(4 marks) A textbook has a total of 1382 pages which is broken into two parts. The second part of the book has 64 more pages than the first part. How many pages are in each part of the book.

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

$$3b(3ax - b) + \frac{4x}{3} = 2$$

$$9abx - 3b^2 + \frac{4x}{3} = 2$$

$$9abx + \frac{4x}{3} = 2 + 3b^2$$

$$x\left(9ab + \frac{4}{3}\right) = 2 + 3b^2$$

$$\boxed{x = \frac{2 + 3b^2}{9ab + \frac{4}{3}}}$$

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

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

$$2x - 4 + x^2 + 2x = -x - 2$$

$$x^2 + 5x - 2 = 0$$

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

$$\boxed{x = 0.372, -5.372}$$

$$2 + \frac{\sin(3 - x^2) + b^2}{b - 1} - \beta^2 = 0$$

$$\frac{\sin(3 - x^2) + b^2}{b - 1} = \beta^2 - 2$$

$$\sin(3 - x^2) + b^2 = (\beta^2 - 2)(b - 1)$$

$$3 - x^2 = \sin^{-1}\left((\beta^2 - 2)(b - 1) - b^2\right)$$

$$\boxed{x = \sqrt{3 - \sin^{-1}\left((\beta^2 - 2)(b - 1) - b^2\right)}}$$

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

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

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

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

$$x\left(1 + b^2 - \cos(2\phi^3)\right) = -1 + b^2 - \cos(2\phi^3)$$

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

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

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

$$1 - \frac{y}{x - 1} + 1 = 0 \qquad (2)$$

Simplify (1):

$$x - 3y + 2 + 3(x-1) = 2(x-1)$$

$$x - 3y + 2 + 3x - 3 = 2x - 2$$

$$2x - 3y = -1 \qquad (1a)$$

Simplify (2):

$$(x-1) - y + (x-1) = 0$$

$$x - 1 - y + x - 1 = 0$$

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

Solve for y in (2a):

$$y = 2x - 2 \qquad (2b)$$

Sub (2b) into (1a)

$$2x - 3[2x - 2] = -1$$

$$2x - 6x + 6 = -1$$

$$-4x = -7$$

$$\boxed{x = \frac{7}{4} = 1.75} \qquad (1b)$$

Sub (1b) into (2b)

$$y = 2\left[\frac{7}{4}\right] - 2$$

$$= \frac{7}{2} - 2$$

$$\boxed{y = \frac{3}{2} = 1.5}$$

(4 marks) A textbook has a total of 1382 pages which is broken into two parts. The second part of the book has 64 more pages than the first part. How many pages are in each part of the book.

let:

X_1 = # of pages in 1st part of book

X_2 = # of pages in 2nd part of book.

So

$$X_1 + X_2 = 1382 \qquad (1)$$

$$X_1 + 64 = X_2 \qquad (2)$$

sub (2) into (1):

$$X_1 + [X_1 + 64] = 1382$$

$$2X_1 + 64 = 1382$$

$$2X_1 = 1318$$

$$\boxed{X_1 = 659} \qquad (1a)$$

sub (1a) into (2)

$$X_2 = [659] + 64$$

$$\boxed{X_2 = 723}$$