Pre TPS

3. State whether or not the following equations are dimensionally consistent:

a. $v = u + at$ b. $v^2 = u^2 + 2ts$ c. $Tan \quad \frac{v_o Sin}{v_o Cos \quad V}$

d. $s = ut + \frac{1}{2} at^2$ e. $v_2^{\ 2} \quad \frac{2(P_1 \quad P_2)}{r} \frac{A_1}{A_1^{\ 2} \quad A_2^{\ 2}}$ f. T

5. Air at standard temperature and pressure flows down a straight pipe, of uniform cross-sectional area 2 sq. ft., at a rate of 1 slug/sec. A penstock valve is quickly closed bringing the flow instantaneously to rest. Assuming no losses, what is the peak rise in static pressure at the valve in lbs/sq.ft. and in lbs/sq. in. How many atmospheres is this pressure rise? (use $P_{tot} = P_s + \frac{1}{2} \quad V^2$) $= 2.37 \times 10^{-3}$ slugs/cu.ft.

Name: _____

Algebra Tutorial

1. Combine:
   a. $2x + (3x - 4y)$ _____

   b. $4x^2 \quad 5x \quad (3x \quad 7) \quad (\ 2x^2 \quad 3)$ _____

   c. $[(x + 2y) - (x + 3y)] - [(2x + 3y) - (-4x + 5t)]$

   _____

2. Add:
   a. $x^2 \quad 2x \quad 1 \quad 3x \quad 4 \quad 2x^2 \quad 5$ _____

   b. $7x \quad 3y^3 \quad 4xy, \quad 3x \quad 2y^3 \quad 7xy, \quad 2xy \quad 5x \quad 6y^3$

   _____

   c. D

   c.

   D D

4. Remove brackets and simplify:

   a. $2(x^2 \quad 4x)$ _____

   b. $-a(2a + 3b)$ _____

   c. $2x[-4(3 + 2y) + (x + y + 1)]$ _____

   d. $2(t^3 \quad 1.4t^2 \quad 2.7t) \quad 4(0.5t^3 \quad t^2 \quad 1.3t)$ _____

5. Multiply and simplify:

   a. $(x + y)(x + 4)$ _____

   b. $(3xy)(2x^2y \quad 3y^2x \quad 3xy)$ _____

   c. $(x \quad y)(x^2 \quad y \quad 3)$ _____

   d. $(p \quad 6q)(p^2 \quad 2pq \quad q^2)$ _____

6. Divide:

a. $(24x^4y^2z^3)\ (\ 3x^3y^4z)$ _____

b. $x^2\quad 2x^4\quad 3x^3\quad x\quad 2\quad x^2\quad 3x\quad 2$

_____

7. Factor:

a. $x^2\quad xy$ _____

b. $x^2\quad y^2$ _____

c. $4x^2\quad y^2$ _____

d. $x^2\quad 7x\quad 6$ _____

e. $x^2\quad 2xy\quad 8y^2$ _____

f. $6x^2y\quad 4y^2x\quad 2$ _____

8. Simplify:

a. $\frac{x^2 \quad xy}{x^2 \quad 3x}$ _____

b. $\frac{x^2 \quad y^2}{(x \quad y)^2}$ _____

c. $\frac{x^2 \quad 3x \quad 2}{2 \quad x}$ _____

9. Express as a single fraction:

a. $\frac{1}{x} \quad \frac{4}{y}$ _____

b. $\frac{4}{3xy} \quad \frac{5}{6yz}$ _____

c. $\frac{6}{x^2 \quad 6} \quad \frac{3x}{x^2 \quad 2}$ _____

Name: _____

Linear & Quadratic Equations Tutorial

1. Solve for x :

   a. $7x - 3 = 25$ _____

   b. $2x + 1 = 3x - 3$ _____

   c. $3(x + 7) - 2(x + 13) = 0$ _____

   d. $\frac{x \quad 2}{x \quad 2} \quad \frac{x \quad 4}{x \quad 4}$ _____

2. Solve for x and y

   a. $3x + 6y = 11$
      $14x - y = 3$ _____

   b. $-3y + 2x = 2$
      $3x + 5y = 41$ _____

c. $3x - 1 = -y + 7$
$x + 3y = 0$ _____

3. Solve for x, y, and z

a. $\begin{aligned} x \quad y \quad z \quad & 0 \\ 3x \quad 3y \quad 3z \quad & 12 \\ x \quad y \quad 2z \quad & 7 \end{aligned}$ _____

b. $\begin{aligned} 2x \quad y \quad 3z \quad & 11 \\ x \quad 2y \quad z \quad & 15 \\ 3x \quad 3y \quad z \quad & 26 \end{aligned}$ _____

4. Solve for x by factorization:

   a. $x^2 \quad 3x \quad 2 \quad 0$ _____

   b. $x^2 \quad 8x \quad 15 \quad 0$ _____

   c. $x^2 \quad 6x \quad 9 \quad 11$ _____

5. Solve for x using the standard quadratic formula:

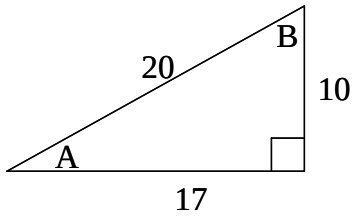
   a. $3x^2 \quad 5x \quad 1 \quad 0$ _____

   b. $2x^2 \quad 6x \quad 3 \quad 0$ _____

Name: _____

Trigonometry Tutorial

1. Given:



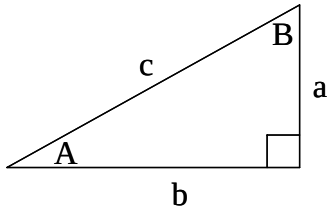
Find: sin A _____

cos A _____

tan A _____

2. Given: sin A = 2/5

c = 5



Find: a _____

b _____

B _____

3. $\sin 45 \quad \frac{1}{\sqrt{2}}$ $\sin 60 \quad \frac{\sqrt{3}}{2}$

cos 45 = _____ cos 60 = _____

tan 45 = _____ sin 30 = _____

sin 0 = _____ tan 60 = _____

cos 0 = _____

4. Given:

6. Show that:

$$\cos 2 = \cos\cos - \sin\sin \qquad \sin 2 = \sin\cos + \cos\sin$$

7. Find the corresponding number of radians or degrees

   a. 315 degrees _____

   b. 120 degrees _____

   c. 100 degrees _____

   d. radians _____

   e. $\frac{5}{4}$ radians _____

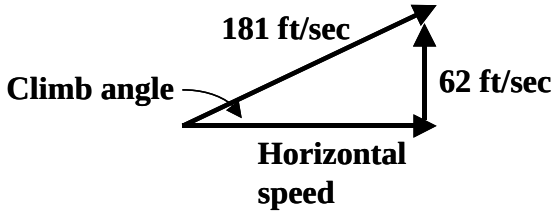
   f. 1.6 radians _____

8. Given an aircraft traveling north at 100 kts into a 20 knot headwind from 350 degrees.

   Find: Ground speed and cross track angle

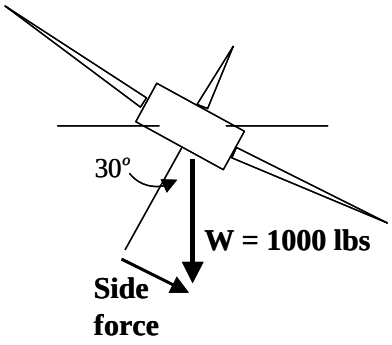
s153b25

9. Given an aircraft flying at 181 ft/sec and climbing at 62 ft/sec.



Find: Horizontal speed and climb angle.

10. Given a 1000 lb aircraft in a 30 degree bank.



Find: Side force.

11. Given:

Assuming small angle theory (is small), why is F_Z L and F_X D?

12. During roll performance testing, the F-99A rolled from 60 degrees left wing down to 60 degrees left wing up in 0.4 seconds.

Find the roll rate in:

Degrees/second _____

Radians/second _____

13. Plot in the same graph the fo

Pre-TPS

Co-ordinate Systems and Graphs Tutorial

1. Find the slopes of the lines through the points:

    a. (3, 5) and (2, -3)

    b. (-1, 2) and (4, -3)

    c. (-2, 4) and (-5, -5)

2. Find the co-ordinates of a point P_1 (x, y) which is located such that the line L_1 through the origin and P_1 has a slope of +2, and the line L_2 through the point P_2 (-1, 0) and P1 has a slope of +1.

3. Plot the given points. Determine analytically whether or not each group lies on a straight line.

    a. P_1 (1, 0), P_2 (0, 1), P_3 (2, -1)

    b. P_1 (-2, -1), P_2 (-1, 1), P_3 (1, 5), P_4 (2, 7)

4. Given P_1 (0, -1), P_2 (4, 0) and P_3 (3, 4), show that $P_1P_2P_3$

10. Find the centers and radii of the given circles:

    a. $x^2 + y^2 - 2y = 3$

    b. $x^2 + y^2 + 2x = 8$

    c. $x^2 + y^2 + 2x - 4y + 1 = 0$

11. If V is the vertex and F the focus of a parabola, find the equations of the following parabolas:

    a. V (0, 0), F (0, 2)

    b. V (-2, 3), F (-2, 4)

    c. V (1, -3), F (1, 0)

12. Given a and b are positive, sketch the parabolas:

    $y^2 = 4a^2 - 4ax$ and

    $y^2 = 4b^2 + 4bx$

13. Sketch the following ellipses:

    a. $9x^2 + 4y^2 = 36$ and

    b. $(x - 1)^2/16 + (y + 2)^2/4 = 1$

Logarithms, Radicals and Exponents
Tutorial

1.

3. Write the following in logarithmic form:

   a. $7^2 \quad 49$ _____

   b. $3^3 \quad 27$ _____

   c. $2^{\,3} \quad \frac{1}{8}$ _____

   d. $\sqrt[3]{8} \quad 2$ _____

4. Write the following in exponential form:

   a. $\log_3 81 \quad 4$ _____

   b. $\log_9 27 \quad \frac{3}{2}$ _____

   c. $\log_{10} 50 \quad 1.699$ _____

5. Simplify the following:

   $\log_{10}(5)(9) \quad \log_{10}\frac{25}{9} \quad \log_{10} 5$ _____

6. Find:

a. $\log_{10} 3860$ _____

b. $\log_{10} 5.46$ _____

c. $\log_{10} .00235$ _____

d. $\log_{10} .0000129$ _____

Complex Numbers

Tutorial

1. Perform the indicated operations:

   a. $(3 - 4i) - (-5 + 7i)$ _____

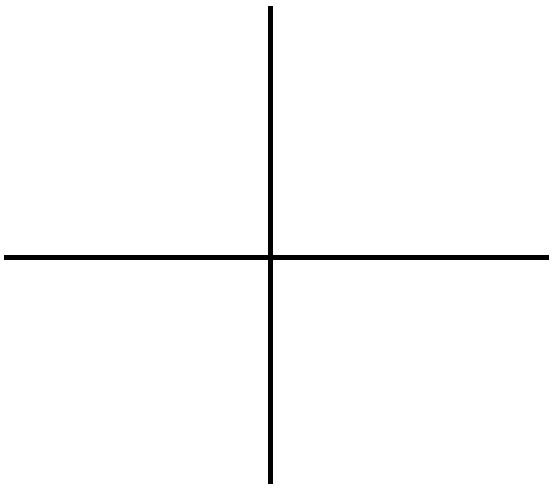
3. Graph the following:

    a. $3 + 2i$

    b. $2 + i$

    c. $-2 - i$

    d. $-1 + 3i$

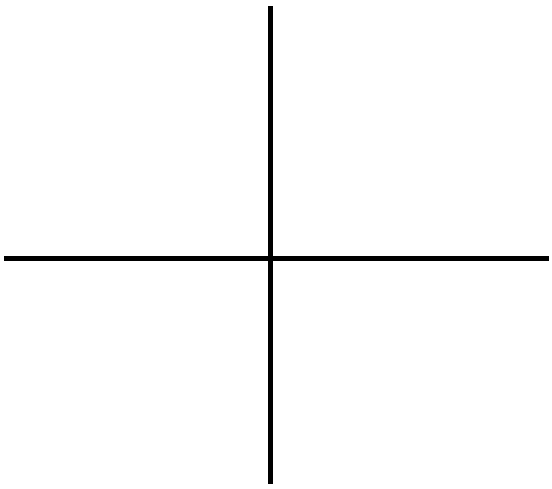


4. Graphically add the following:

    a. $(3 + 4i) + (2 - 3i)$

    b. $(3 - 4i) + (2 + i)$

    c. $(-3 + 3i) - (2 + i)$



5.

7. Use De Moivre's theorem to evaluate the following and express results in a + bi form:

   a. $\sqrt{}$

Determinant & Matrix
Tutorial

1. Solve the following determinants:

a. $\begin{vmatrix} 2 & 4 \\ 3 & 5 \end{vmatrix}$

b. $\begin{vmatrix} 3 & 4 \\ 2 & 7 \end{vmatrix}$

c. $\begin{vmatrix} 1 & 1 & 1 \\ 3 & 3 & 3 \\ 1 & 1 & 2 \end{vmatrix}$

d. $\begin{vmatrix} 3 & 1 & 1 \\ 5 & 6 & 4 \\ 0 & 1 & 2 \end{vmatrix}$

2. Solve the following using Cramer's Rule

$x + y + z = 0$

$3x – 3y - 3z = 12$

$x –y + 2z = -7$

3. Add or subtract the following matrices

a.
$$\begin{matrix} 2 & 4 \\ 3 & 5 \end{matrix} \quad \begin{matrix} 3 & 4 \\ 2 & 7 \end{matrix}$$

b.
$$\begin{matrix} 1 & 1 & 1 \\ 3 & 3 & 3 \\ 1 & 1 & 2 \end{matrix} \quad \begin{matrix} 3 & 1 & 1 \\ 5 & 6 & 4 \\ 0 & 1 & 2 \end{matrix}$$

4. Multiply the following

$$3 \begin{matrix} 3 & 1 & 5 & 6 & 4 \\ 0 & 1 & 1 & 1 & 2 \end{matrix}$$

5. Transpose

$$\begin{matrix} 3 & 1 \\ 2 & 4 \\ 7 & 5 \end{matrix}$$

6. Write the following set of equations in matrix form

$$2x + 7y = 26$$
$$5x - 2y = 14$$

7. Solve for x, y, and z [Hint: Cramer]

$$\begin{matrix} 1 & 2 & 1 & x & 4 \\ 3 & 4 & 2 & y & 2 \\ 5 & 3 & 5 & z & 1 \end{matrix}$$

5. Given:

$$\overline{A} \quad 3\hat{i} \quad \hat{j} \quad 4\hat{k}$$

$$\overline{B} \quad 2\hat{i} \quad 4\hat{j} \quad 3\hat{k}$$

$$\overline{C} \quad \hat{i} \quad 2\hat{j} \quad \hat{k}$$

Find a. $2\overline{A} \quad \overline{B} \quad 3\overline{C}$

b. $\left|\overline{A} \quad \overline{B} \quad \overline{C}\right|$

^

6A Given:

8. Evaluate $\hat{j}.\,2\hat{i} \quad 3\hat{j} \quad \hat{k}$.

9. Given:

$\overline{A} \quad i \quad j \quad k$ XgU xtUÐ]x #ÀrE]e& /XE•YE„XyrXE@%r#ektvÀ

$\overline{B} \quad i \quad j$ 3k̂3j

Pre-TPS
Differentiation
Tutorial

1. Using the relationship:

6. Given: $y^2 + x - 4 = 0$

   Find $\frac{dy}{dx}$

7. Given: $x^2 + 2xy - 3y^2 + 11 = 0$

   Find $\frac{dy}{dx}$ and evaluate at the point (2,3)

8. Find $\frac{d^2y}{dx^2}$ for the following:

   a. $y = 3x^4 - 2x^3 + 6$

   b. $y = 4ax^{1/2}$

   c. $y = (x + 2)(x \quad 3)$ hint – expand first

   d. $y - x^2 - 12 = x^7 + 3x^4 + 4x^2 \quad x + 10$

9. Given: $s = 120t - 16t^2$

   Find the velocity, ds/dt, and the acceleration, d^2s/dt^2

   Evaluate the velocity and acceleration at t = 2

10. Find maximum and minimum values for x and y given:

    a. $y = x^3 + 2x^2 - 15x - 20$

    b. $y = x^2 - 10$

    Sketch both graphs.

PreTPS
Integration
Tutorial

1. Integrate the following non-definite integrals

   a. $x^3 \quad 6x^2 \quad 7\ dx$

   b. $\dfrac{dx}{x^2}$

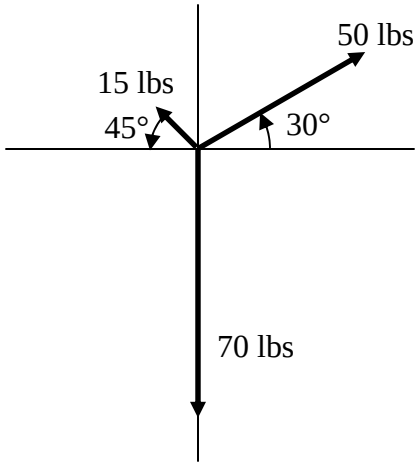
   c. $\dfrac{2x \quad 1}{x^2 \quad x}\,dx$

13 IInegrale iby-1.87e-parts. x3Tj10.0005 0.505 TD20Tj1.3571 9TK()Tj11.9 0 0 10.9 02214312Tm()Tj1.5310 T()j2.920 TD

   d. 3xHdB])Ê&Bëqi1@ThdpÀ

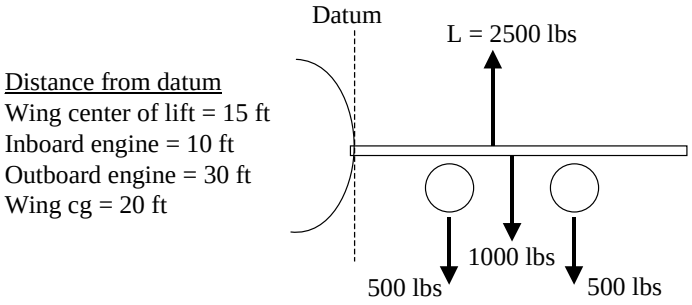
Statics and Friction Tutorial

1. Given:



Find the resultant force (magnitude and angle)

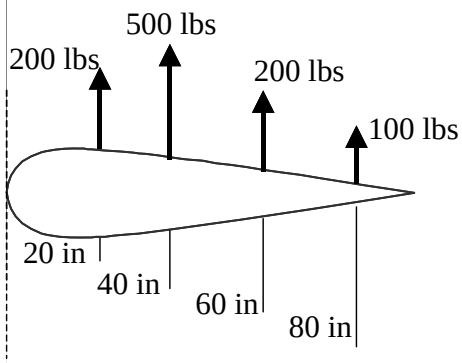
2. Given:



Find: M around datum

3. Given:

5. Given:



   a. Find the resultant force (F_R)

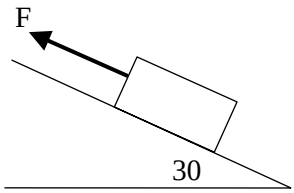
   b. Find the distance from the leading edge to the resultant force ($\bar{x}$).

   c. Transfer the resultant force to the 25 inch point and determine the resultant moment .

6. Given:

   Find the minimum force required to move the block.

7. Given:



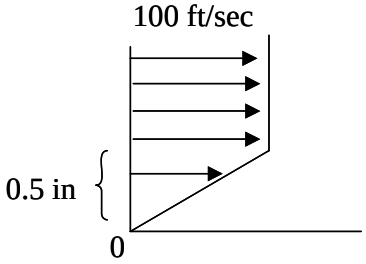
Weight of block = 150 lbs

$\mu_s = 0.3$

Find: a) Minimum force required to hold the block at rest.

b) Maximum force required to hold the block at rest.

8. Given:



Calculate $\frac{dV}{dy}$ from this data

$$1.2x10^{5}\ \frac{lb\ \sec}{ft^2}$$

Find: a) $\frac{dV}{dy}$

b)

c) Shear force acting over a 200 ft^2 area

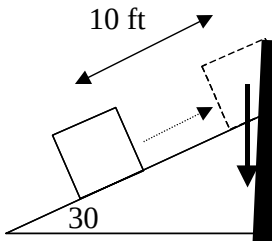
9. Consider an aircraft weighing 125,000 lbs taxing on the ground.

Assuming that:

- the reaction force on the nose wheel is 25,000 lbs;
- the reaction force on the main gear is 100,000 lbs (50,000 lbs per wheel)
- the radius of the nose wheel is 25 in;
-

Work and Energy
Tutorial

1. Determ
the incline as shown. A



2. Determine the amount of work done in #1 above if =0.2

3. What is the potential energy of a 240,000 lb aircraft flying at 36,000 ft and 380 kts? [(kts)(1.68) = ft/sec]

What is the kinetic energy?

What is the total specific energy?

4. A 10,000 lb fighter experiences an engine flame-out at 30,000 ft and 1200 ft/sec airspeed. Assuming no energy losses during a zoom climb, calculate the maximum altitude when the aircraft reaches 500 ft/sec velocity.

5. An aircraft is flying at 35,000 ft and 1000 ft/sec airspeed. The aircraft weighs 35,000 lbs.
    a. Find the specific energy of the aircraft

    b. Assuming no losses, find the maximum velocity of the aircraft at sea level.

6. A spring is compressed 6 inches. (K = 300 lb/in) If a 50 lb object is placed on top of the compressed spring and the spring is released.
    a. What is the spring force before release?

    b. Calculate the stored energy in the spring before it is released.

    c. What is the velocity of the object at separation from the spring. (assume Stored energy = KE)

Kinematics
Tutorial

Take g as 32 ft/sec^2

1. A train's speed increases uniformly from 30 mi/hr to 60 mi/hr in 5 minutes. Determine the average speed, the distance traveled and the acceleration.

2. A stone dropped from a tower strikes the ground in 3 sec. Determine the height of the tower.

3. A stone is thrown vertically upwards with a velocity of 96 ft/sec. Calculate the time taken to reach the highest point; the greatest height reached; and the total time before the stone hits the ground.

4. A 3 lb body is whirled on a 4 ft string in a horizontal circle. Calculate the tension in the string if the speed is: (a) 8 ft/sec, (b) 2 revolutions per second (RPS).

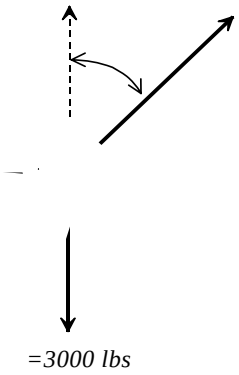
5. A body rests in a pail which is moved in a vertical circle of radius 2ft. What is the least speed the body must have so as not to fall out when at the top of the path?

Newton's Laws
Tutorial

1. Given the following diagram of an aircraft in flight:

   a.

2. Given the following turning aircraft:



=3000 lbs

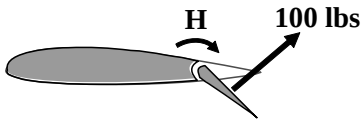
Assume: T = D = 2000 lbs

ɛ aircraft in level flight? Why?

Calculate the vertical acceleration

3. Given a 100 lb force striking and inclined plate as shown, compute resultant force (RAF).

4. In the following diagram a control surface is deflected down 45^{o}. Assume the airflow striking the deflected surface creates the resultant 100 lb force.



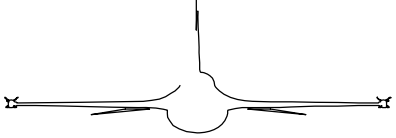
a. In order to hold the deflected surface in place how much hinge moment (H) is required?

b. If the hinge suddenly breaks, what will be the horizontal acceleration of the deflected surface [Assume the deflected surface weights 10 lbs]

5. An aircraft weighing 20,000 lbs (including payload) drops a 5,000 lb bomb from straight, level unaccelerated flight. Calculate the vertical acceleration of the aircraft immediately after dropping the bomb.

2. The roll mode ( ) time constant is a measure of how quickly the maximum roll rate (p) can be reached.

$$f\left(\frac{I_x}{damping}\right)$$

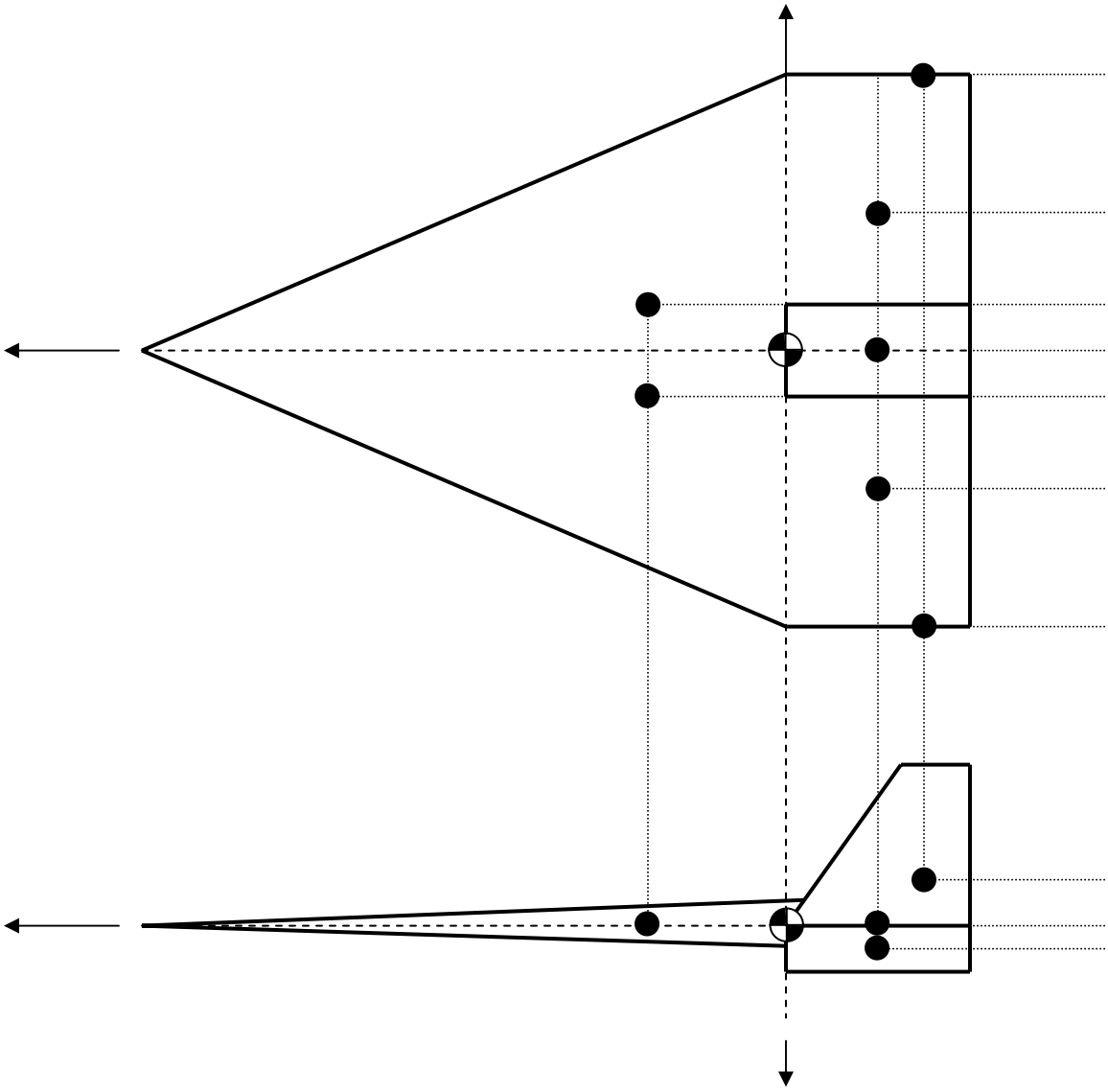


[A]

[B]

Match the roll mode time constant with the appropriate configuration.

3. Given the following future X-airplane, calculate the moments of inertia (Ix, Iy, Iz) and the products of inertia (Ixy, Iyz, Ixz).



Momentum and Impulse
Tutorial

1. An 8gm bullet is fired horizontally into a 9kg block of wood which is free to move. The velocity of the block and bullet after impact is 40cm/sec. Calculate the initial velocity of the bullet.

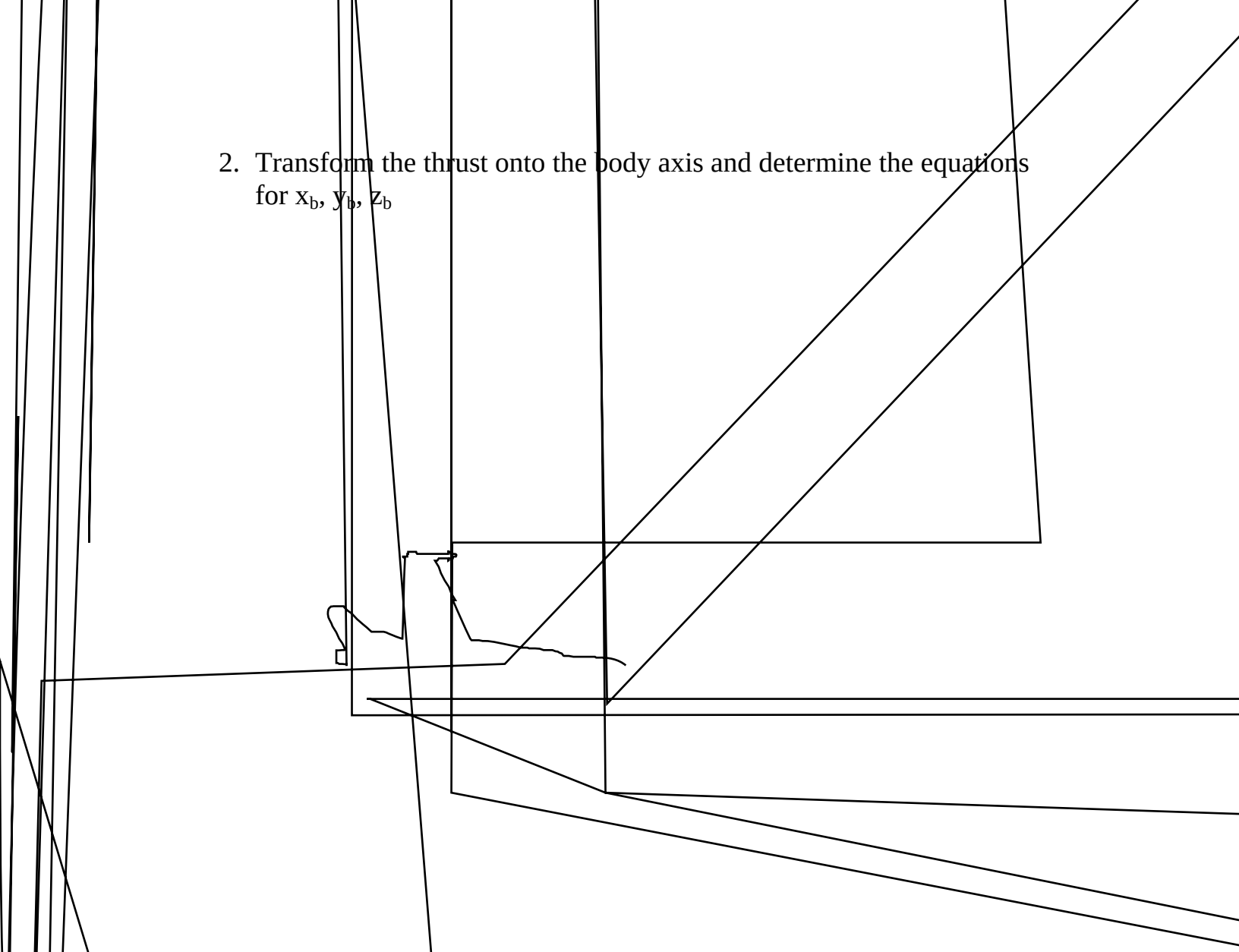
2. A 600lb gun mounted on wheels fires a 10lb projectile with a muzzle velocity of 1800ft/sec at an angle of 30^{o} above the horizontal. Calculate the horizontal recoil velocity of the gun.

3. Two inelastic masses of 16 and 4 grams move in opposite directions with velocities of 30 and 50 cm/sec respectively. Determine the resultant velocity after impact if they stick together.

4. An 8lb body is acted on by a force for a period of 4 sec during which it gains a velocity of 20ft/sec. Determine the magnitude of the force.

5. A 10-ton locomotive moving at 2ft/sec collides with and is coupled to a 40-ton car at rest on the same straight track. What is their common velocity after impact?

2. Transform the thrust onto the body axis and determine the equations for x_b, y_b, z_b

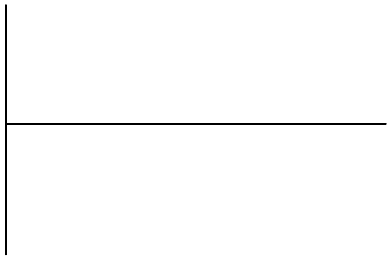


3. Write the following in matrix form

$$\begin{matrix} x_a & x_b \cos & z_b \sin \\ y_a & y_b & \\ z_a & x_b \sin & y_b \cos \end{matrix}$$

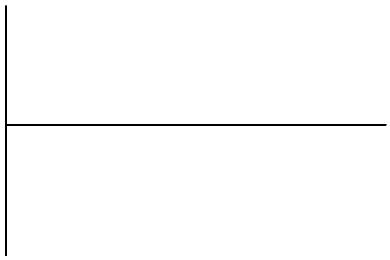
Motion Analysis
Tutorial

1. Draw a typical trace for the following oscillating system.
   a. Positive damped (stable)

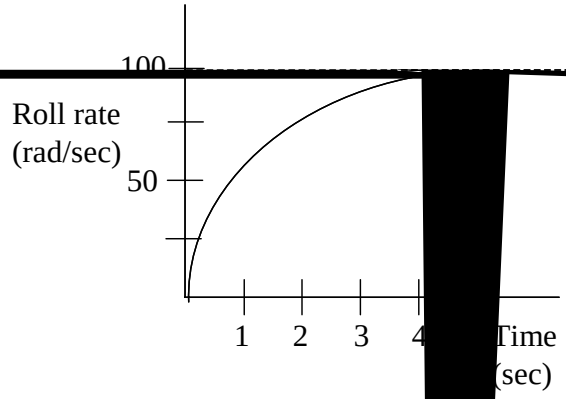


   b. Neutral damped (neutral)

   c. Negative damped (unstable)



following 1st order response



a. Estimate

b. Write the time history respons uation

c. Is the response convergent or rgent?

3. Given the following "s-domain" equa s

$s + .0095 = 0$

$s^2 \quad .875s \quad 18.4 \quad 0$

a. Find time constant ( )

b. Find natural frequency ($_n$)

c. Find damping ratio ( )