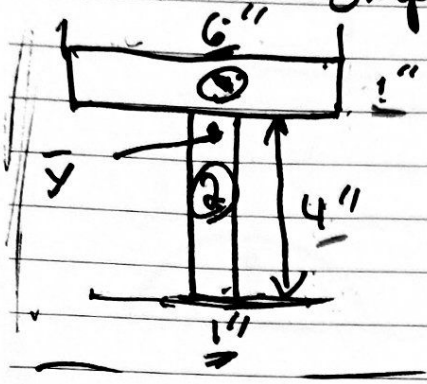
Date 5/04/2026 M T W T F S S

Problem of the Day 106!

Find the moment of inertia of the shape! about the X



$$\bar{y} = \frac{\Sigma A_i y_i}{\Sigma A_i}$$

$$I_x = \frac{1}{12} bh^3 + Ad^2$$

① Find $\bar{y}$

	A	y	Ay
1	6	4.5	27
2	4	2	8

$A_1 = 1 \cdot 6 = 6 in^2$

$A_2 = 1 \cdot 4 = 4 in^2$

$y_1 = 4 + 1/2 = 4.5"$

$y_2 = 4/2 = 2"$

$$\bar{y} = \frac{27+8}{6+4} = \frac{35}{10} = 3.5"$$

②

$$I_{x_{shape_1}} = \frac{1}{12}(6)(1)^3 + 6 \cdot 1^2 = 6.5 in^4$$

$d_1 = 4.5 - 3.5 = 1$

$d =$ Centroid of Parent shape $- \bar{y}$

③

$$I_{x_{shape_2}} = 1/2\,(1)(4)^3 + 4 \cdot 1.5^2 = 14.33 in^4$$

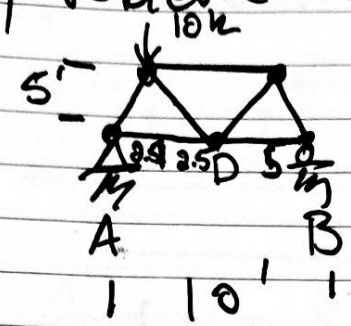
$d = 2 - 3.5 = -1.5 \rightarrow +1.5$

④ $I_{x\,total} = 6.5 + 14.33 = \boxed{20.83 in^4}$

Moment of inertia about the X

Date 5/05/2026 M T W T F S S

Problem of the Day 107!



Solve for the reaction forces!

$$\circlearrowleft \Sigma M_A = 0 = B_y(10) - 2.5(10)$$

$$\boxed{B_y = 2.5^{-k}}$$

$$+\uparrow \Sigma F_y = 0 = -10 + 2.5 + A_y$$

$$\boxed{+\uparrow A_y = 7.5^{k}}$$

Date 5/06/2026 M T W T F S S

Problem of the Day 108!

$$\left(\sqrt{2}\right)^2 = ?$$

---

① Change the exponent!

$$\left((2)^{1/2}\right)^2 \rightarrow 2^{(1/2)\cdot 2} \rightarrow 2^{2/2}$$

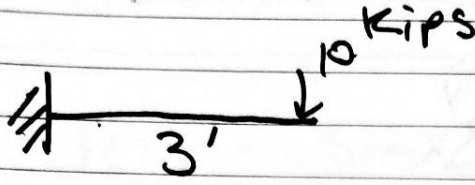
$$\rightarrow 2^1 = \boxed{2}$$

If you see a root!
rewrite in exponent form!

Date 5/07/2026 M T W T F S S

Problem of the Day 109!

Find the Deflection of the Steel Beam! Steel $E = 29{,}000\ ksi$

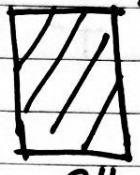


$$\Delta = \frac{PL^3}{3EI}$$

$L = 3' = 36''$

$P = 10\ kips = 10{,}000\ lbs$

Cross section ← a 36 steel



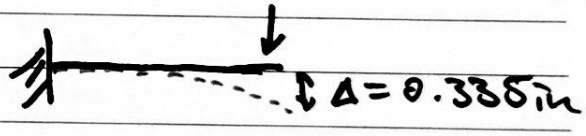
$E = 29{,}000\ ksi$

$I = \frac{1}{12}bh^3 = \frac{1}{2}(3)(4)^3 = 16\ in^4$

$E = 29{,}000\ ksi$

$$\Delta = \frac{(10\ kips)\cdot(36'')^3}{3(29{,}000\ ksi)(16\ in^4)} = \frac{466{,}560}{1{,}392{,}000}$$

$\Delta = 0.335\ in$



All units are KEY!!!

Date 5/08/2026 M T W T F S S

Problem of the Day 110!

Distribute $(x^2 + 4x^2)3x$

$(x^2 + 4x^2)3x$

↓

$3x^3 + 4 \cdot 3\, x^3$

$3x^3 + 12x^3 = \boxed{15x^3}$

Date 5/09/2026 M T W T F S S

Problem of the Day !!!!

Find the derivative !

$\sin(3x^2+4x) = f(x)$

$f(x) = \sin(3x^2+4x)$

$= \cos(3x^2+4x)(6x+4)$

$= (6x+4)\cos(3x^2+4x)$

Date 5/10/2026 M T W T F S S

Problem of the Day 1121

Find the value of the limit!

$$\lim_{x \to 2} \frac{2x^3 - 7x^2 - 14x - 5}{x^2 - 25}$$

$$= \frac{2(2)^3 - (2)^2 - 14(2) - 5}{(2)^2 - 25}$$

$$= \frac{2(8) - 7(4) - 28 - 5}{4 - 25}$$

$$= \frac{16 - 28 - 28 - 5}{4 - 25}$$

$$= \frac{-45}{-21} = \frac{15}{7} = 2\frac{1}{7}$$

Date 5/11/2026 M T W T F S S

Problem of the Day 113! Solve the problem by using the definition of a derivative

$f(x) = x^2$ $\quad f'(x) = \lim_{h\to 0} \frac{f(x+h) - f(x)}{h}$

Set up the problem!

$$f'(x) = \lim_{h\to 0} \frac{f(x+h) - f(x)}{h} = \lim_{h\to 0} \frac{(x+h)^2 - x^2}{h}$$

$$= \lim_{h\to 0} = \frac{(x+h)(x+h) - x^2}{h} = \lim_{h\to 0} \frac{x^2+xh+xh+h^2-x^2}{h}$$

Factor out an h

$$= \lim_{h\to 0} \frac{2xh+h^2}{h} = \lim_{h\to 0} \frac{h(2x+h)}{h(1)}$$

Now plug in the limit!

$$= \frac{h}{h} \cdot \frac{2x+0}{1} = \boxed{2x} = f'(x)$$

Check with the polynomial rule!

$f(x) = x^2 \rightarrow 2x^{2-1} = \boxed{2x = f'(x)}$

Personally the setup is the hardest because of the h!

Date 5/12/2026 M T W T F S S

Problem of the Day 114!

Solve the problem using the definition of a derivative.

$f(x) = \sqrt{x}$ $\quad f'(x) = \lim_{h\to 0} \frac{f(x+h) - f(x)}{h}$

$$f'(x) = \lim_{h\to 0} \frac{(\sqrt{x+h}) - \sqrt{x}}{h} = \lim_{h\to 0} \frac{((\sqrt{x+h}) - \sqrt{x})}{h} \cdot \frac{((\sqrt{x+h}) + \sqrt{x})}{((\sqrt{x+h}) + \sqrt{x})}$$

$$= \lim_{h\to 0} \frac{((\sqrt{x+h}) - \sqrt{x}) \cdot (\sqrt{x+h} + \sqrt{x})}{h(\sqrt{x+h} + \sqrt{x})}$$

$$= \lim_{h\to 0} \frac{x+h + (\sqrt{x+h})(\sqrt{x}) - ((\sqrt{x})(\sqrt{x+h})) - x}{h(\sqrt{x+h} + \sqrt{x})}$$

$$= \lim_{h\to 0} \frac{h + \sqrt{x^2+hx} - \sqrt{x^2+hx}}{h(\sqrt{x+h} + \sqrt{x})} = \lim_{h\to 0} \frac{h}{h(\sqrt{x+h} + \sqrt{x})}$$

Factor out an h

$$= \lim_{h\to 0} \frac{h}{h} \cdot \frac{1}{\sqrt{x+h} + \sqrt{x}} = \frac{1}{\sqrt{x+0} + \sqrt{x}} = \boxed{\frac{1}{2\sqrt{x}}}$$

Plug in the limit

check with the polynomial Rule!

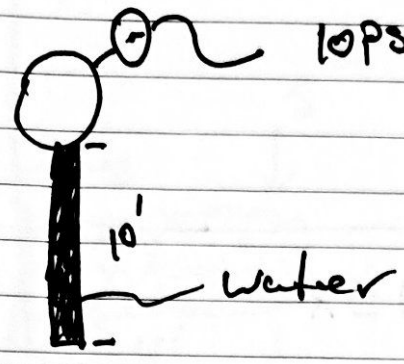
$f(x) = \sqrt{x} \rightarrow (x)^{1/2} = \frac{1}{2}(x)^{1/2-1} = \frac{1}{2}x^{-1/2}$

$\boxed{f'(x) = \frac{1}{2\sqrt{x}}}$ ✓✓

Date 5/13/2026 M T W T F S S

Problem of the Day 115!

What is the total pressure at the bottom of the system?



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pressure = gauge + water column

= 10psi + water column

psf = 10 · 62.4 = 624 psf

psi_{water} = 624 psf / 144 = $4.33\overline{3}$ psi

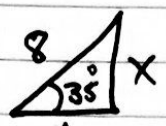
= 10 psi + $4.33\overline{3}$ psi

= $14.33\overline{3}$ psi

Date 5/14/2026 M T W T F S S

Problem of the Day 116!

Solve for the x side of the triangle.



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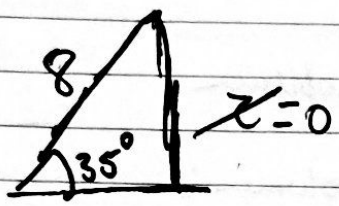
soh cah toa

h



$0 = x$

$\sin(\theta) = \frac{o}{h}$

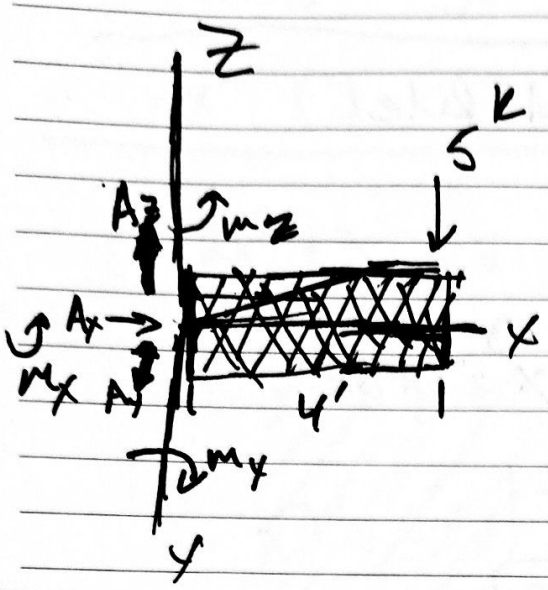
$\sin(35°) = \frac{0}{8}$

$8\sin(35°) = 0$

$0 = x = 4.59$

Date 5/15/2026 M T W T F S S

Problem of the Day 117!
Solve for the reaction forces!



$\Sigma f_y = 0$

$\Sigma f_x = 0$

$\Sigma m_z = 0$

$\Sigma m_x = 0$

$\Sigma F_z = 0 = A_z - 5^k$

$\boxed{5^k = A_z}$

$+) \Sigma M_y = 0 = (4 \cdot 5) + M_y$ (k-ft)

$-M_y = 20^{k\text{-}ft}$

So M_y is the other direction

$\boxed{\curvearrowright M_y = 20^{k\text{-}ft}}$

Date 5/16/2026 M T W T F S S

Problem of the Day 118!

Take the Derivative

Use the polynomial Rule!

$f(x) = 12x^2 + 5x^3 + x$

$f'(x) = 12 \cdot 2x^{2-1} + 5 \cdot 3x^{3-1} + x^{1-1}$

$f'(x) = 24x + 15x^2 + 1$

$\boxed{f'(x) = 15x^2 + 24x + 1}$

Date 5/17/2026 M T W T F S S

Problem of the Day 119!

Solve for x!

$2x^2+3=4$

$2x^2+3=4$

$2x^2=4-3$

$2x^2=1$

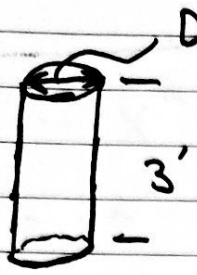
$x^2=\frac{1}{2}$

$$x=\pm\sqrt{\frac{1}{2}}=\pm\frac{\sqrt{2}}{2}$$

Date 5/18/2026 M T W T F S S

Problem of the Day 120!

Find the volume of the cylinder!



$A = \pi r^2$

$= \pi \cdot 0.5^2 = 0.785\ ft^2$

Volume $= A \cdot h = 0.785 \cdot 3$

$V = 2.356\ ft^3$

Date 5 / 19 / 2026 M T W T F S S

Problem of the Day 121!

Take the derivative!

$f(x) = \sin(4x+1)$

$f'(x) = \cos(4x+1)\ 4$

$\boxed{f'(x) = 4\cos(4x+1)}$

Date 5/20/2026 M T W T F S S

Problem of the Day 122!

Solve the Derivative!

$$x^2 \sin(x) = f(x)$$

$$x^2 \sin(x) = f(x)$$

$f(x) = x^2$

$g(x) = \sin(x)$

$f'(x) = 2x$

$g'(x) = \cos(x)$

Product rule!

$$F'(x) = f(x)g'(x) + f'(x)g(x)$$

$$\boxed{f'(x) = x^2 \cos(x) + 2x \sin(x)}$$

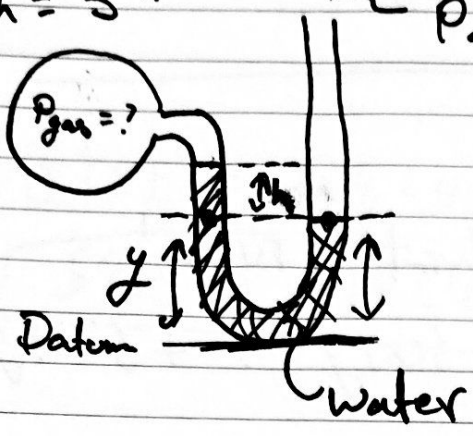
Date 5/21/2026 M T W T F S S

Problem of the Day 123!

Find the pressure in the tank!

Water $\Delta = 5'' = h$

~~h~~ $h = 5''$



$P_{atm} = 14.7 \text{ psi}$

$P_{gas} = P_{atm} \pm \gamma h$

$= 14.7 \text{ psi} - \gamma h$

$\gamma = 62.4 \text{ lb/ft}^3$

$$\gamma = \frac{62.4 \text{ lb}}{\text{ft}^3} \left| \frac{\text{ft}^3}{12^3 \text{ in}^3} \right. = 0.036 \text{ lbs/in}^3$$

$h = 5''$

$P_{gas} = 14.7 \text{ psi} - 0.036(5) = \boxed{14.52 \text{ psi}}$

Date 5/22/2026 M T W T F S S

Problem of the Day 124!

Simplify the problem!

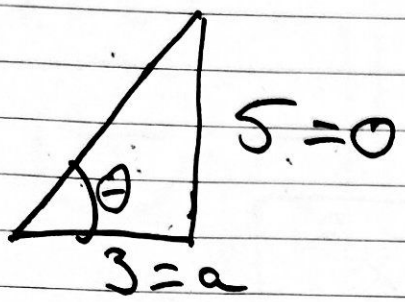
$$4x^2 + x^2$$

$$4x^2 + 1x^2 = \boxed{5x^2}$$

Date 5/23/2026 M T W T F S S

Problem of the Day 125!

Solve the problem by finding θ



Soh cah toa

$$\tan(\theta) = \frac{o}{a}$$

$$\theta = \tan^{-1}\left(\frac{5}{3}\right)$$

$$= \tan^{-1}(1.67)$$

$$\boxed{\theta = 59^\circ}$$

Date 5/24/2026 M T W T F S S

Problem of the Day 126!

Solve the problem!

$3x^4 - 7x^4$

$3x^4 - 7x^4 = \boxed{-4x^4}$

Date 5/25/2026 M T W T F S S

problem of the Day 127!

Solve the problem/ simplify by factoring!

$$(3x^4 + x^2)$$

$$(3x^2 \cdot x^2 + 1 \cdot x^2)$$

$$\downarrow$$

$$\boxed{x^2(3x^2 + 1)}$$

Date 5/26/2026 M T W T F S S

Problem of the Day 128!

$$\int 2x \sin(x^2)\, dx$$

---

① $\int 2x \sin(u)\, dx$

② $u = x^2$

$du = 2x\, dx$

$\frac{du}{2x} = dx$

$\int \cancel{2x} \sin(u) \frac{du}{\cancel{2x}}$

$\int \sin(u)\, du$

$-\cos(u) + C$

↓

$\boxed{-\cos(x^2) + C}$

Date 5/27/2026 M T W T F S S

Problem of the Day 1291!

You have an annual interest rate of 7% + you Invest $1,200 a year for 40 years how much money will you have?

$$F = A\left[\frac{(1+i)^n - 1}{i}\right]$$

$A = \$1,200$

$i = 0.07$

$n = 40$

$$F = A\left[\frac{(1+i)^n - 1}{i}\right]$$

$$= 1,200\left[\frac{(1.07)^{40} - 1}{0.07}\right]$$

$$= 1,200\left[\frac{14.9 - 1}{0.07}\right]$$

$$= 1,200 \cdot 199.64$$

$$\boxed{F = \$239,562}$$

Date 5/28/2026 M T W T F S S

Problem of the Day 130!

Bernoulli Equation!

$$P_1 + \frac{1}{2}\rho v_1^2 + \rho g h_1 = P_2 + \frac{1}{2}\rho v_2^2 + \rho g h_2$$

+

$$P_1 + \frac{1}{2}\rho v_1^2 + \rho g h_1 = \text{constant}$$

P = Pressure (static pressure of fluid @ X-section)

ρ = Density of fluid

V = Mean velocity of the fluid! in X-section

g = acceleration due to gravity

h = Elevation of water X-section = Z

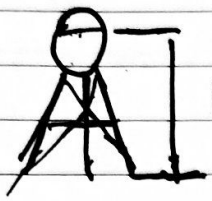
$$\boxed{P} + \frac{1}{2}\rho v^2 + \boxed{\rho g Z}$$

- P: pressure "Energy" (pressure head)
- $\frac{1}{2}\rho v^2$: kinetic "Energy" (velocity head)
- $\rho g Z$: potential "Energy" (Elevation head or head)

Date 5/29/2026 M T W T F S S

Problem of the Day 131!

A water tower is 175 feet tall how much pressure is the water putting on the bottom of water tower? or how much head is there?



hight of water

$$\text{head} = 175'$$

$$P = \gamma g h$$

$$\gamma g = \gamma$$

$$\gamma_w = 62.4\ lb/ft^3$$

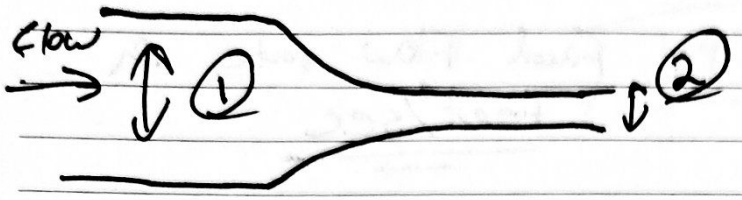
$$P = 62.4\ lb/ft^3 \cdot 175 = 10{,}920\ psf$$

Or 75.8 psi

Date 5/30/2026 M T W T F S S

Problem of the Day 132!

Solve for the velocity (V_2) in the system!



$Q = VA$

Q = flow rate
V = Velocity
A = X-sectional area

$A_1 = 12 in^2$
$Q_1 = 100 in^3/sec$
$h_1 = 0$
$V_1 = ?$
ρ = constant

$A_2 = 6 in^2$
$Q_2 = Q_1$
$V_2 = ?$
ρ = constant

$Q = VA$ $\quad Q_1 = V_1 A_1 \rightarrow \frac{Q_1}{A_1} = V_1$

$\frac{100 in^3/sec}{12 in^2} = 8.33 in/sec = V_1$

Since $Q_1 = Q_2$ then

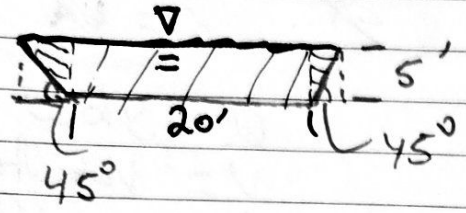
$Q_2 = V_2 A_2 \rightarrow \frac{Q_2}{A_2} = V_2$

$\frac{100 in^3/sec}{6 in^2} = 16.67 in/sec = V_2$

Date 5/31/2026 M T W T F S S

Problem of the Day 133!

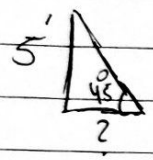
Find the flow rate of the channel! Channel velocity is 3mph



$v = 3 mph$

Find Flow rate in $feet^3/sec$

(1) Find Area of Channel!



SOH CAH TOA

$\tan(\theta) = \frac{o}{a}$

$\tan(45°) = \frac{5'}{a}$

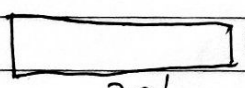
$a = \frac{5}{\tan(45°)}$

$5 = a$

A of triangle $= \frac{1}{2}bh = \frac{1}{2} \cdot 5 \cdot 5 = 12.5$

$A_{T_1} + A_{T_2} = 12.5 + 12.5 = 25\ ft^2$

$A_{rectangle} = 20 \cdot 5 = 100\ ft^2$



$A_{Total} = 125\ ft^2$

(2) convert units for velocity!

$$\frac{3 \text{ miles}}{\text{hour}} \left| \frac{5{,}280\ ft}{1 \text{ mile}} \right| \frac{1 \text{ hour}}{60 \text{ min}} \left| \frac{1 \text{ min}}{60 \text{ sec}} \right. \rightarrow \frac{3 \cdot 5{,}280}{60 \cdot 60}$$

$= 4.4\ ft/sec$

(3) Plug into equation!

$Q = VA \rightarrow = 4.4 \cdot 125 = 550\ ft^3/sec$

Date 6/01/2026 M T W T F S S

Problem of the Day #34!

Convert From Kg to Newton's

---

5 Kg = how many N on Earth

$5 \cdot 9.81 = \boxed{49.05\ N}$

Date 6 / 02 / 2026 M T W T F S S

Problem of the Day 135!

Numbers to Remember!

$\gamma_{water} = 62.4\ lb/ft^3$

1 mile = 5,280 ft

gravity = $32.2\ ft/sec^2$

gravity = $9.81\ m/sec^2$

Density of water = $1000\ kg/m^3$

1 gallon of water = 8.34 pounds

Date 6/03/2026 M T W T F S S

Problem of the Day 136!

e!

---

e is a constant the same way pi is a constant

$e \approx 2.718281828$

e is the base of the natural log

* mainly in exponential growth!

Date 6/04/2026 M T W T F S S

Problem of the Day 137!

What is 20% of 30% of 150

20% = 0.2

30% = 0.3

→ 0.2 · 0.3 → 0.06 = 6%

0.06 · 150 = **9**

Date 6/05/2026 M T W T F S S

Problem of the Day 138!

$3x + 6 = 15$ solve for x

$3x + 6 = 15$

$3x = 9$

$\boxed{x = 3}$

$3x + 6 - 6 = 15 - 6$

$3x = 9$

$\frac{3x}{3} = \frac{9}{3}$

$\boxed{x = 3}$

Date 6/06/2026 M T W T F S S

Problem of the Day 139!

how far will you go in 95min @ 100 mph?

$$\frac{100 \text{ miles} \,/\, \text{hour}}{\text{hour} \,/\, 60 \text{ min}} = 1.67 \text{ miles/min}$$

$$1.67 \cdot 95 = \boxed{158.3 \text{ miles}}$$

Date 6/07/2026 M T W T F S S

problem of the Day 140!

What is the Kinetic energy of a 2kg object moving @ 6m/s!

$KE = \frac{1}{2} m v^2$

$V = 6 m/s$

$2 kg = mass$

$Kt = \frac{1}{2}(2)(6)^2 =$ 36 Joules

$J = \frac{kg \cdot m^2}{s^2}$