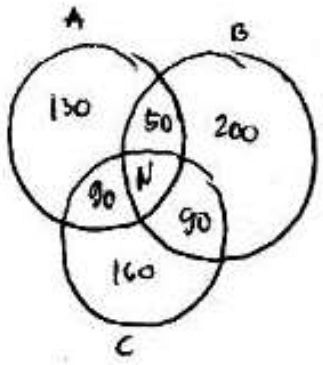
Answer Key

ENGINEERING MATHEMATICS

Refresher 01

130 A only
200 B only
160 C only
380 A or B but not C
480 B or C but not A
380 C or A but not B
1200 persons

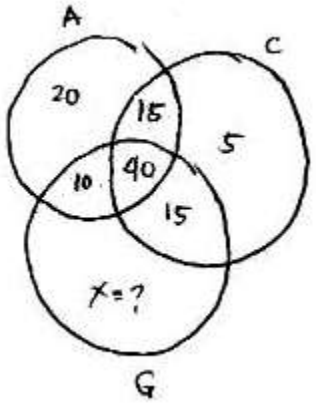


$130 + 50 + 200 + 90 + 160 + 90 + N = 1200$

$N = 480$

2

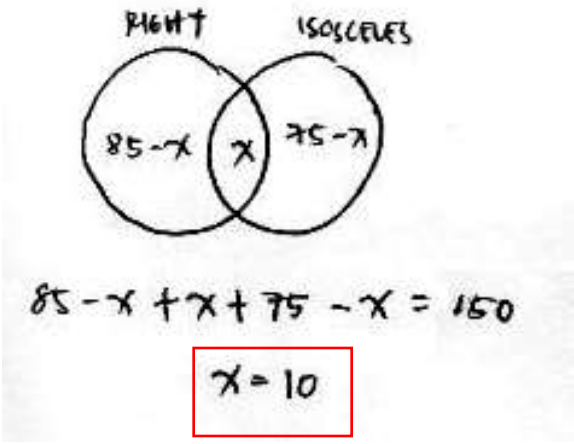
Subjects: Algebra
Calculus
Geometry



$20 + 15 + 5 + 15 + 40 + 10 + X = 150$

$X = 45$

3



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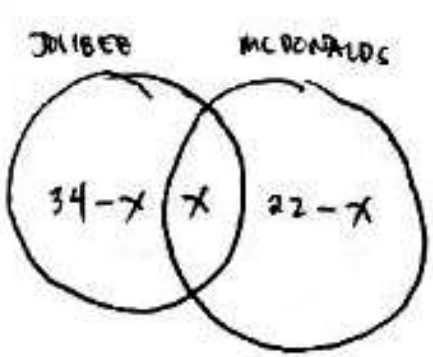
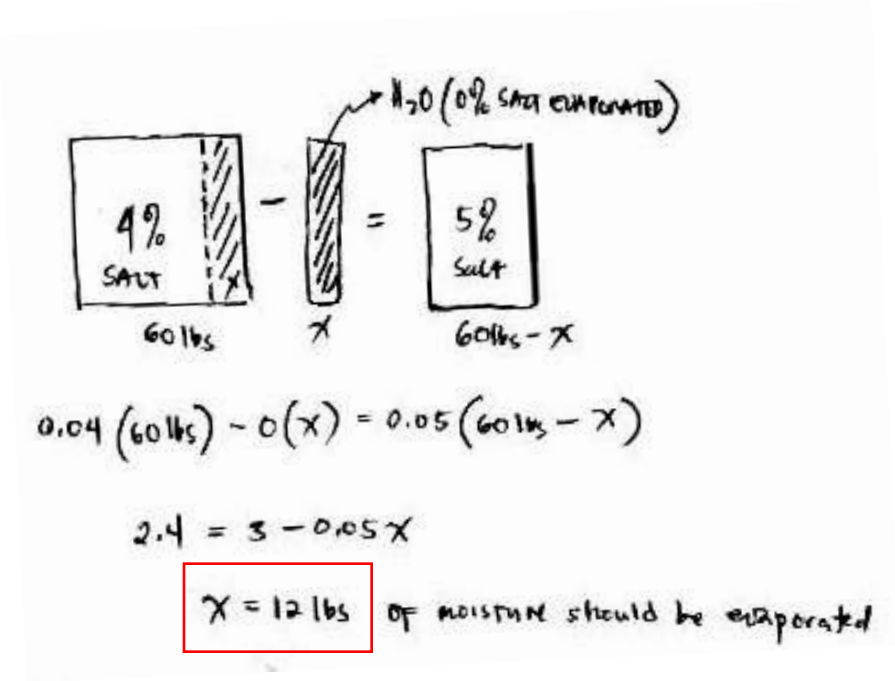


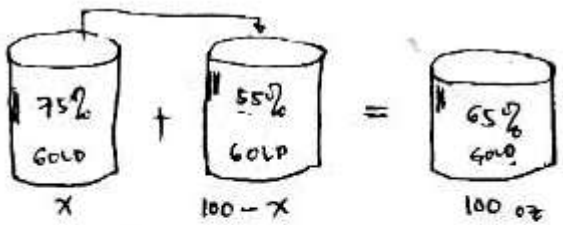
$$34 - x + x + 22 - x = 50$$

$$x = 6$$

5


H_2O (0% SALT EVAPORATED)
4% SALT
X
60 lbs
X
5% Salt
60lbs - X
0.04 (60 lbs) - 0(X) = 0.05 (60 lbs - X)
2.4 = 3 - 0.05X
X = 12 lbs OF MOISTURE should be evaporated

6

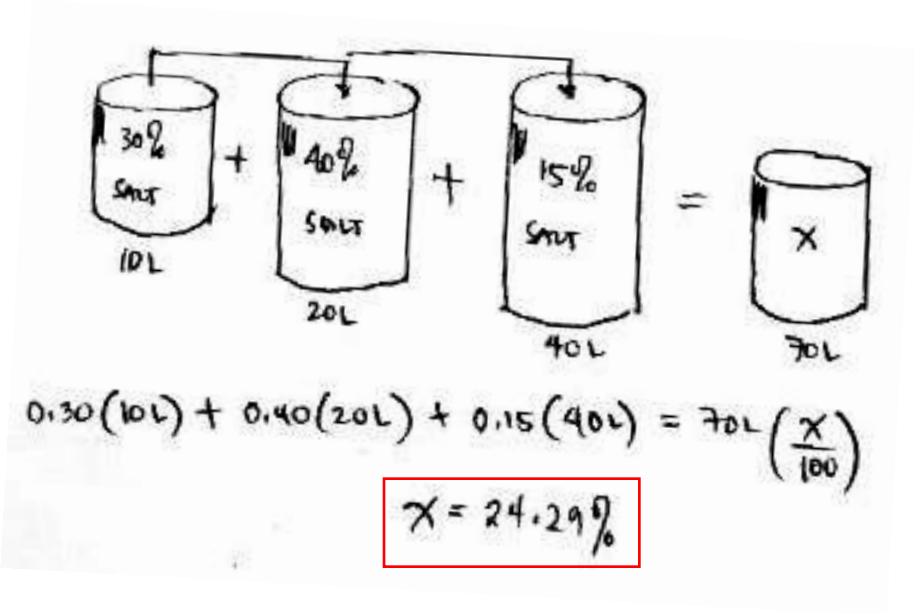


$$0.75(x) + 0.55(100 - x) = 0.65(100)$$

$$0.75x + 55 - 0.55x = 65$$

$$x = 50 \text{ oz}$$

7



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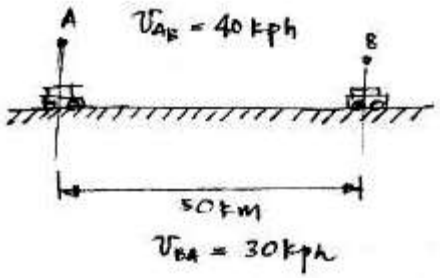


$$V_{ave} = \frac{S_{AB} + S_{BA}}{t_{AB} + t_{BA}}$$

for t_{AB};

$$t_{AB} = \frac{S_{AB}}{V_{AB}} = \frac{50\ km}{40\ km/hr} = 1.25\ hrs$$

for t_{BA};

$$t_{BA} = \frac{S_{BA}}{V_{BA}} = \frac{50\ km}{30\ km/hr} = 1.6667\ hrs$$

Hence;

$$V_{ave} = \frac{(50+50)\ km}{(1.25+1.6667)\ hrs}$$

$$V_{ave} = 34.2853\ km/hr$$

9

sq. meters per second

10

Economic Life

11

Maximum at the wall

12

Feather bedding

13

Cycloid

14

Exponential LEAP ONLINE REVIEW

Investment

15

There is an upper bound on the quantity ordered

16

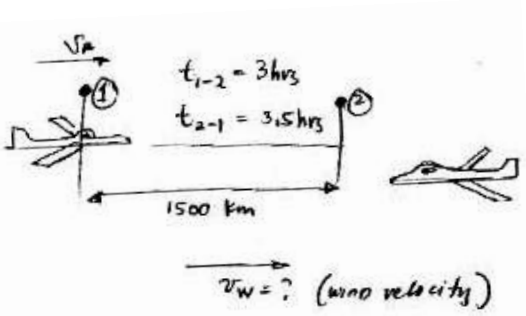
The gray cast iron contains flakes of graphite, whereas the ductile cast iron contains spheroids of graphite.

Evaluation over different time periods

18

70 kPa

19



$$S_{1-2} = S_{2-1}$$

$$V_{1-2}\, t_{1-2} = V_{2-1}\, t_{2-1}$$

$$(V_A + V_W)\, t_{1-2} = (V_A - V_W)\, t_{2-1}$$

then; $V_{1-2} = \dfrac{S_{1-2}}{t_{1-2}}$

$$(V_A + V_W) = \frac{1500\ km}{3\ hrs} = 500\ kph$$

$$V_A = 500 - V_W$$

Substi;

$$\left(500\ \frac{km}{hr}\right)(3\ hrs) = \left(500\ \frac{km}{hr} - V_W - V_W\right) 3.5\ hrs$$

$$V_W = 35.7143\ km/hr$$

20

$$R_B = 2R_A \quad \longleftarrow 1$$

$$(R_A + R_B)T = 1 \quad \longleftarrow 2 \text{ working together}$$

$$R_B T_B = 1 \quad \longleftarrow 3 \text{ for B to do it alone}$$

$$(R_A + R_B)7 = 1$$

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

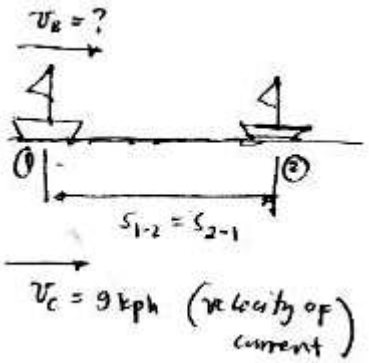
$$R_B = \frac{2}{21}$$

thus;

$$\left(\frac{2}{21}\right)T_B = 1$$

$$\boxed{T_B = 10.5 \text{ days}}$$

21



$$t_d = \frac{2}{3} t_u$$

$$s_{1-2} = s_{2-1}$$

$$v_{B_{1-2}} t_d = v_{B_{2-1}} t_u$$

$$(v_B + v_c)\frac{2}{3} t_u = (v_B - v_c) t_u$$

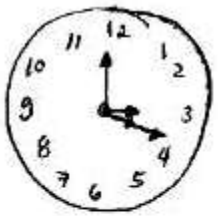
$$1.5 v_B - v_B = v_c + 1.5 v_c$$

$$0.5 v_B = 2.5 v_c$$

$$v_B = \frac{2.5(9 \text{ kph})}{0.5}$$

$$\boxed{v_B = 45 \text{ km/hr}}$$

22



$$x = t\left(\frac{12}{11}\right)$$

$$x = 15\left(\frac{12}{11}\right)$$

$$x = 16.3636 \text{ minutes}$$

time is = 3:16.36

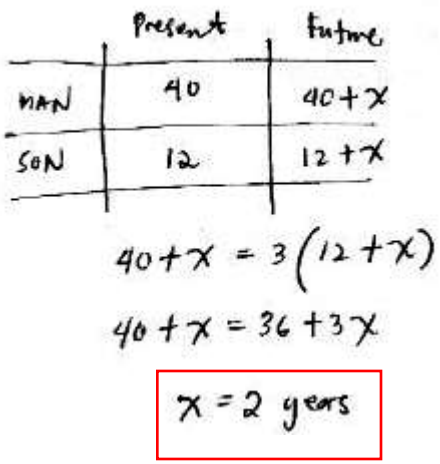
23

$$x = t\left(\frac{12}{11}\right)$$

$$x = 5\left(\frac{12}{11}\right)$$

$$x = 5.4545 \text{ mins.}$$

24



	Present	future
MAN	40	$40+x$
SON	12	$12+x$

$$40+x = 3(12+x)$$

$$40+x = 36+3x$$

$$x = 2 \text{ years}$$

25

	PAST	present
MARIO	$3x-6$	$3x$
SONNY	$x-6$	x

$$3x-6 = 6(x-6)$$
$$3x-6 = 6x-36$$
$$x = 10 \text{ years}$$

26

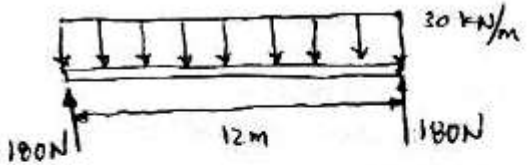
	Present	future
MIKE	x	$x+3$
Alberto	$20-x$	$(20-x)+3$

$$x+3 = 2[20-x+3]$$

$$x+3 = 40-2x+6$$

$$x = 14-\frac{1}{3} \text{ years}$$

27



$$M_{max} = \frac{WL^2}{8} = \frac{(30\ kN/m)(12m)^2}{8}$$

$$M_{max} = 540\ kN\text{-}m$$

28

$$S = \frac{Pd}{2t}$$ tangential stress

$$30{,}000\ \frac{lb}{in^2} = \frac{(3{,}800\ lb/in^2)(12\ in)}{2t}$$

$$t = (0.76\ in)\left(\frac{25.4\ mm}{1\ in}\right)$$

$$t = 19.304\ mm$$

29

0 – 25

30

(quantity purchased*actual price) – (quantity purchased*std. price)

Bid bulletin

Gross margin

The sludge and raw sewage are not mixed

34

The ratio of current assets (exclusive of inventory) to the total current liabilities

35

100% minus % net salvage value all over the estimated service life

36

ROI

Condonation

38

Silver gray

39

$$S_{all} = \frac{S_y}{FS}$$

$$\frac{(8330\ kPa)(0.783\ m)}{2t} = \frac{216300\ kPa}{4}$$

$$t = (0.06031\ m)\left(\frac{100\ cm}{1\ m}\right)$$

$$t = 6.0309\ cm$$

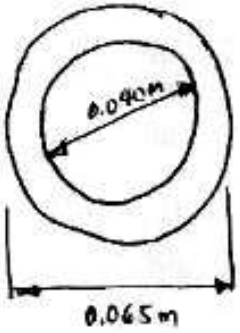
40

$$S = \frac{Pd}{2t}$$

$$8000\ \frac{lb}{in^2} = \frac{(150\ lb/in^2)(20\ in)}{2t}$$

$$t = 0.2625\ in$$

41

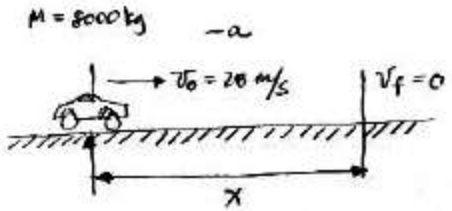


$$J = \frac{\pi}{32}(D^4 - d^4)$$

$$= \frac{\pi}{32}(0.065^4 - 0.040^4)\ m^4$$

$$J = 1.5012 \times 10^{-6}\ m^4$$

42



$[\Sigma F_x = 0]$

$ma - F_f = 0$

$\mu N - ma$

$(0.55)(8000\ kgs)\left(\frac{9.81\ N}{1\ kg}\right) = (8000\ kg)\,a$

$a = 5.3955\ m/s^2$

from: $v_f^2 = v_0^2 - 2ax$ ($v_f = 0$)

$2(5.3955\ m/s^2)\,x = (28\ m/s)^2$

$x = 72.6531\ m$

43

BANKING ANGLE

$$\tan\theta = \frac{v^2}{gr}$$

$$\left(50\ \frac{\text{miles}}{\text{hr}}\right)\left(\frac{5280\ \text{ft}}{1\ \text{mile}}\right)\left(\frac{1\ \text{m}}{3.28\ \text{ft}}\right)\left(\frac{1\ \text{hr}}{3600\ \text{s}}\right) = 22.3577\ \text{m/s}$$

Substi

$$\tan 6.5^\circ = \frac{(22.3577\ \text{m/s})^2}{(9.81\ \text{m/s}^2)r}$$

$$r = 447.2256\ \text{m}$$

To provide machine with appropriate guards

45

Theorem

Class D Fire – Fire caused by LPG

Objectionable vibration to the building and occupied space

48

Resultant

49

Proportion

50

Depend on the materials and the finish condition on the surface

51

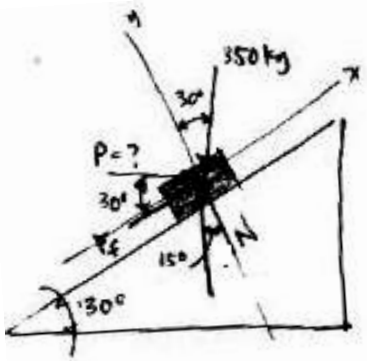
Exponential LEAP ONLINE REVIEW

Weight

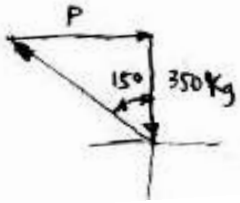
Theorem

Circle

54



Force triangle:

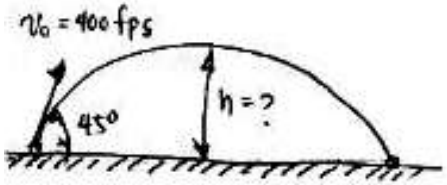


By Sine Law:

$$\frac{P}{\sin 15^\circ} = \frac{350\ kg}{\sin 75^\circ}$$

$$P = 93.7822\ kg$$

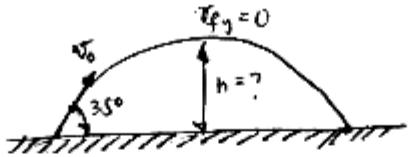
55



$$h = \frac{v_0^2 \sin^2\theta}{2g} = \frac{(400\ \text{ft/sec})^2 \sin^2(45^\circ)}{2(32.2\ \text{ft/sec}^2)}$$

$$h = 1242.2360\ \text{ft}$$

56



$$v_{fy} = v_o \sin\theta - gt$$

$$0 = v_o \sin 35° - (9.81\ m/s^2)(8\ sec)$$

$$v_o = 136.8257\ m/s$$

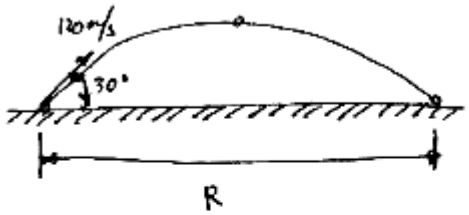
subst;

$$h = \frac{v_o^2 \sin^2\theta}{2g} = \frac{(136.8257\ m/s)^2 \sin^2(35°)}{2(9.81\ m/s^2)}$$

$$h = (313.92\ m)\left(\frac{3.28\ ft}{1\ m}\right)$$

$$h = 1029.6576\ ft$$

57



$$R = \frac{V_0^2 \sin 2\theta}{g} = \frac{(120\ m/s)^2 (\sin 60°)}{9.81\ m/s^2}$$

$$R = 1271.2299\ m$$

58

Let: x = be the number
y = the other number

$x + y = 12 \longrightarrow y = 12 - x$

product $= xy \longrightarrow xy = x(12 - x)$

Then; $\frac{dP}{dx} = x(12 - x) = 12x - x^2$

$0 = 12 - 2x$

$x = 6$

Largest possible product is 36

59

$$\lim_{x \to 1} \frac{x^2 - 1}{x^2 + 3x - 4}$$

$$\lim_{x \to 1} \frac{2x}{2x + 3}$$

$$\lim_{x \to 1} \frac{2(1)}{2(1) + 3} = \boxed{\frac{2}{5}}$$

60

$y^2 - 4y - 12x - 40 = 0$

$(x-h)^2 = 4a(y-k)$ standard equation of a parabola w/ vertical directrix

$y^2 - 4y = 12x + 40$

$y^2 - 4y + 4 = 12x + 40 + 4$

$(y-2)^2 = 12\left(x + \frac{11}{3}\right)$

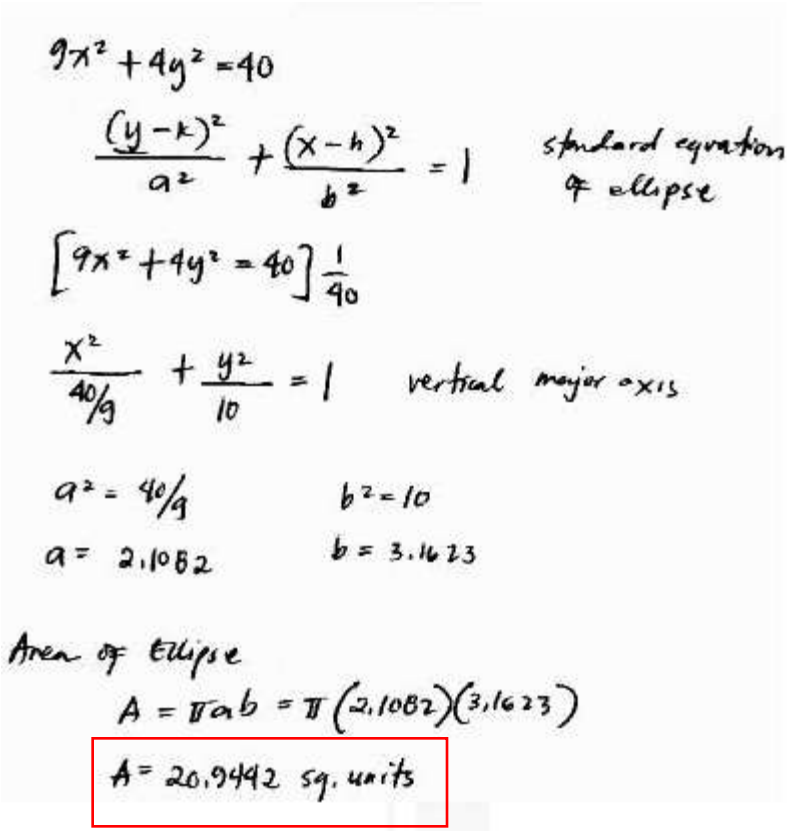
$V\left(-\frac{11}{3}, 2\right)$

$4a = 12$

$2a = 6$

$\boxed{a = 3}$ distance between focus and vertex of the parabola

61



$9x^2 + 4y^2 = 40$

$\frac{(y-k)^2}{a^2} + \frac{(x-h)^2}{b^2} = 1$ standard equation of ellipse

$\left[9x^2 + 4y^2 = 40\right]\frac{1}{40}$

$\frac{x^2}{40/9} + \frac{y^2}{10} = 1$ vertical major axis

$a^2 = 40/9$ $\quad b^2 = 10$

$a = 2.1082$ $\quad b = 3.1623$

Area of Ellipse

$A = \pi ab = \pi(2.1082)(3.1623)$

$A = 20.9442$ sq. units

62

$$x^2+y^2-2x+4y-28=0$$

completing squares

$$x^2-2x+1+y^2+4y+4=28+1+4$$

$$(x-1)^2+(y+2)^2=33$$

center; $C(h,k)$

$$C(1,-2)$$

63

Distance between line $5x - 4y + 6 = 0$
to point $(3, 2)$

$$d = \frac{|Ax + By + C|}{\sqrt{A^2 + B^2}} = \frac{5(3) + (-4)(2) + 6}{\sqrt{5^2 + (-4)^2}}$$

$$d = 2.0303$$

64

$m = 4$

y-intercept $= 1$

$y = mx + b$

$y = 4x + 1$

$4x - y + 1 = 0$

65

Hypotenuse

Hydrometer

PSME

68

PME

Sunk cost

Monopoly

71

Has twice the strength as a rivet in single shear

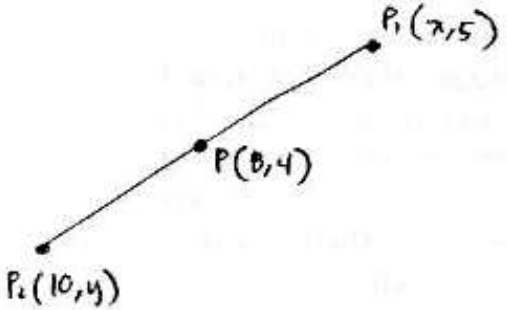
72

Gratuitous

Conservation of mass

Pitching

75



$$x = \frac{x_1 + x_2}{2} \quad ; \quad y = \frac{y_1 + y_2}{2}$$

$$8 = \frac{x + 10}{2} \quad ; \quad 4 = \frac{5 + y}{2}$$

$$\boxed{x = 6} \quad ; \quad \boxed{y = 3}$$

76

Area of a triangle

$$A = \frac{1}{2}\begin{vmatrix} x_1 & x_2 & x_3 \\ y_1 & y_2 & y_3 \end{vmatrix}$$

$$A = \frac{1}{2}\begin{vmatrix} 1 & 4 & 6 & 1 \\ 1 & -4 & -4 & 1 \end{vmatrix}$$

$$A = \frac{1}{2}\left[(-4-16+6)-(4-24-4)\right]$$

$$A = 5 \text{ sq. units}$$

77

DISTANCE Between two points

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{(5+3)^2 + (-4-6)^2}$$

$$d = 12.8062 \text{ units}$$

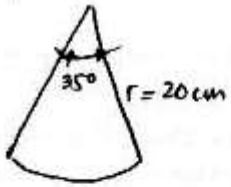
78

Dodecagon = 12 sides

$$\text{Interior angle} = \frac{n-2}{n}(180°)$$

Interior angle = 150°

79

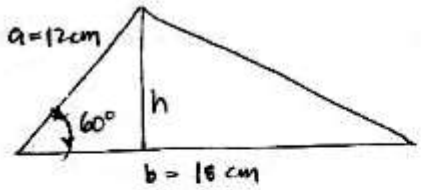


$A_{sector} = \frac{1}{2} r^2 \theta$; θ = radians

$= \frac{1}{2} (20\,cm)^2 \left(35°\right)\left(\frac{\pi}{180°}\right)$

$A_{sector} = 122.1730\ cm^2$

80



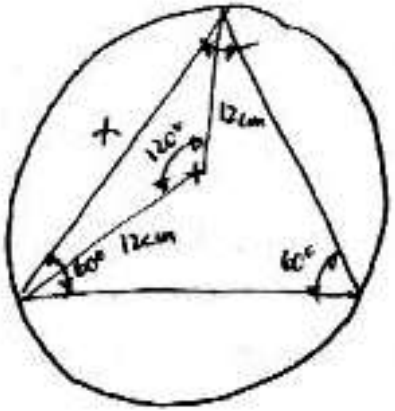
Area of the triangle

$$A = \frac{1}{2} bh$$

$$A = \frac{1}{2} ba\sin\theta = \frac{1}{2}(18\,cm)(12\,cm)\sin 60°$$

$$A = 93.5307 \text{ sq. cm}$$

81



Sine Law:

$$\frac{x}{\sin 120^\circ} = \frac{12}{\sin 30^\circ}$$

$$x = 20.7846$$

82

$$\log_g 45 = x$$

$$g^x = 45$$

$$\ln g^x = \ln 45$$

$$x \ln g = \ln 45$$

$$x = \frac{\ln 45}{\ln g}$$

$$\boxed{x = 1.7325}$$

or use calculator

83

Exponential LEAP ONLINE REVIEW

$\log 3 = x$

$\log 4 = y$

find $\log 1.5$ in terms of x and y

subst $x = 0.4771$ and $y = 0.6021$ to choices

to obtain $\log 1.5$ equal to 1.7609

choose: $3x + y - 2$

84

$$\log_4 4 + \log_4 x = 5$$

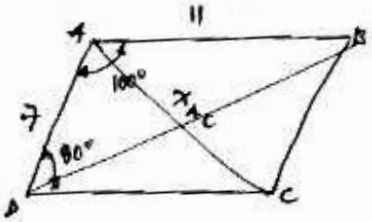
$$1 + \log_4 x = 5$$

$$\log_4 x = 4$$

$$x = 4^4$$

$$\boxed{x = 256}$$

85



Sum of Angles $= (n-2)(180°)$

$= (4-2)(180°)$

$= 360°$

Cosine Law

$$x_{AC}^2 = 7^2 + 11^2 - 2(7)(11)\cos 80°$$

$$x_{AC} = 11.9691$$

Venturi meter

Specific Speed

It is a Newtonian Fluid

Mario is freely falling

90

45 deg

The friction of the air

92

The force of earth's gravity is greater than that of the moon

Cross current exists

94

greater

95

Polyhedron

96

$$\sin(270° + A) = \sin 270 \cos A + \cos 270 \sin A$$

$$= -1 \cos A + 0(\sin A)$$

$$\boxed{\sin(270° + A) = -\cos A}$$

OR use calculator and assign value for A

97

$\sin A = 3.522x$

$\cos A = 4.155x$

$\sin 2A = 4.945x$

Find x;

$\sin 2A = 2 \sin A \cos A$

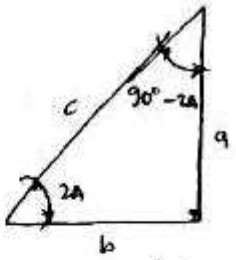
$4.945x = 2(3.522x)(4.155x)$

$x = 0.16896$

98

if $\sec 2A = \frac{1}{\sin 3A}$

$\sec 2A = \csc 3A$



$\sec 2A = \frac{c}{b}$, $\csc(90-2A) = \frac{c}{b}$

from; $\csc(90^\circ - 2A) = \sec 2A$

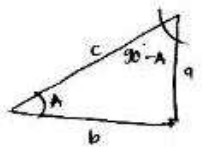
$\csc(90^\circ - 2A) = \csc 3A$

$90^\circ - 2A = 3A$

$A = 18^\circ$

99

If $\sin 3A = \cos 6B$, then



$\sin A = \frac{a}{c}$ $\quad \cos(90-A) = \frac{a}{c}$

$\tan A = \frac{a}{b}$ $\quad \cot(90-A) = \frac{a}{b}$

$\sec A = \frac{c}{b}$ $\quad \csc(90-A) = \frac{c}{b}$

Hence; we arrive w/ the ff. relationships

$\cos(90-A) = \sin A$ ——— (a)

$\cot(90-A) = \tan A$ ——— (b)

$\csc(90-A) = \sec A$ ——— (c)

Using (a) to create relationship

$\cos(90-A) = \sin A$

$\cos(90-3A) = \sin 3A$

$\cos(90-3A) = \cos 6B$

$[90-3A = 6B]\ \frac{1}{3}$

$30 - A = 2B$

$A + 2B = 30$

100

Exponential LEAP ONLINE REVIEW

$\sin A = \frac{3}{4}$; find $1 - \cos A$

$A = \sin^{-1}\left(\frac{3}{4}\right)$

$A = 48.5904°$

Hence;

$1 - \cos A = 1 - \cos(48.5904°)$

$= 0.33856$