435) 1 n $\quad \frac{1}{(\log 2)^2} + \frac{1}{(\log 3)^3} + \frac{1}{(\log 4)^4} + \cdots + \frac{1}{(\log n)^n} + \frac{1}{[\log(n+1)]^{n+1}} + \cdots$

$\cancel{\lim_{n\to\infty} u_n = 0}$ $\quad (u_1 > u_2,\ u_3 > u_4,\ \text{etc.})$, $\therefore$ ~~divergent~~

$$\lim_{n\to\infty} \left[\frac{1}{[\log(n+1)]^{n+1}} \cdot (\log n)^n \right] = 0 \checkmark$$

$$\left[[\log(n+1)]^n \cdot \log(n+1) \right]$$

$$\left(\frac{\log(n+1)}{\log n}\right)^n$$

435) 1 o

$$\frac{3}{1!\cdot 2} + \frac{3^2}{2!\cdot 2^2} + \frac{3^3}{3!\cdot 2^3} + \frac{3^4}{4!\cdot 2^4} + \cdots + \frac{3^n}{n(2^n)} + \frac{3^{n+1}}{(n+1)2^{n+1}} + \cdots$$

~~This is geometric series~~, $r = \frac{3}{2} > 1$,

$$\lim_{n\to\infty} \mu_n = 0 \quad \lim_{n\to\infty} \left[\frac{\cancel{3^{n+1}}\,3}{\cancel{(n+1)}\cdot \cancel{2^{n+1}}\,2} \cdot \frac{\cancel{n \cdot 2^n}}{\cancel{3^n}} \right] = \frac{3}{2} \therefore \text{~~divergent~~}$$

$(1+1/n)$

436) 2a $\quad 1 - \frac{3^2}{2!} + \frac{3^4}{4!} - \frac{3^6}{6!} + \frac{3^8}{8!} - \cdots - \frac{3^{(2n-2)}}{(2n-2)!} + \frac{3^{2n}}{(2n)!} - \cdots$

(↑ correct?)

all positive → $\lim_{n\to\infty} u_n = 0$

~~1.2.3 —— (2n-2)~~

$$\rho = \lim_{n\to\infty} \left(\frac{\cancel{3^{2n}}\,9}{\cancel{(2n)!}} \cdot \frac{\cancel{(2n-2)!}}{\cancel{3^{(2n-2)}}} \right) = \cancel{\frac{2n-2n}{3^2}} = \cancel{\frac{1}{n}} = 0$$

~~1.2.3 --- (2n-2)~~ (2n-1) 2n

each term is numer. less than prec. term

ser. conv.

436) 2b

$$1-\frac{1}{\sqrt[3]{2}}+\frac{1}{\sqrt[3]{3}}-\frac{1}{\sqrt[3]{4}}+\frac{1}{\sqrt[3]{5}}-\cdots-\frac{1}{\sqrt[3]{n}}+\frac{1}{\sqrt[3]{n+1}}-\cdots$$

all positive, $\lim_{n\to\infty} u_n = 0$ $\quad 1+\frac{1}{\sqrt[3]{2}}+\frac{1}{\sqrt[3]{3}}+\cancel{\frac{1}{\sqrt[3]{4}}}$ div.;

Then compared ē ~~Harmonic series~~ (div.), it is term for term larger, ∴ divergent.

However, in alternating form, ~~S_n approaches 0 as limit~~, (grouping [−++]) ∴ converges.

∴ series is conditionally convergent

---

436) 2e $\quad 1-\frac{1}{2}+\frac{1}{3^3}-\frac{1}{4}+\frac{1}{5^3}-\frac{1}{6}+\frac{1}{7^3}-\frac{1}{8}+\frac{1}{9^3}-\cdots\frac{1}{n}+\frac{1}{(n+1)^3}$

~~S_n approaches $(-\infty)$ as $n\to\infty$~~, ∴ ~~divergent~~ ~~diverges~~.

$$1+\frac{1}{3^3}+\frac{1}{5^3}+\frac{1}{7^3}+\frac{1}{9^3}+\cdots \quad \text{conv.}$$

$$-\frac{1}{2}-\frac{1}{4}-\frac{1}{6}-\frac{1}{8}-\cdots$$

$$-\frac{1}{2}\left(1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\cdots\right) \quad \text{div.}$$

438) 1

$$\frac{x}{2\cdot 5}+\frac{x^2}{3\cdot 5^2}+\frac{x^3}{4\cdot 5^3}+\cdots\frac{x^n}{(n+1)5^n}+\frac{x^{n+1}}{(n+2)5^{(n+1)}}+\cdots$$

$$\cancel{\rho = \lim_{n\to\infty}\left(\frac{(n+1)5^n}{(n+2)5^{(n+1)}}\right) = \lim_{n\to\infty}\frac{n+1}{(n+2)5}}$$

$$\cancel{\rho = \frac{1}{5}} \qquad \lim_{n\to\infty}\left[\frac{\cancel{x^{n+1}}\,x}{\cancel{(n+2)5^{n+1}}\,5}\cdot\frac{(n+1)\cancel{5^n}}{\cancel{x^n}}\right] = x/5$$

Thus, series ~~converges for $|x| < \frac{1}{n}$ or 5~~

~~" diverges for $|x| > \frac{1}{n}$~~

ser. conv. when $\left|\frac{x}{5}\right| < 1$, $\to |x| < 5$

$-5 < x < 5$

ser. div. when ~~$|x/5| > 1$~~, when $|x| > 5$

$$1-\frac{1}{2}+\frac{1}{3}-\frac{1}{4}+\frac{1}{5}-\cdots \quad \text{conv.}$$

$$1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}+\cdots$$

when $|x| < 5$ ser. conv.

when $|x| > 5$ ser. div.

$(-5 \leqq x < 5)$

when $|x| = 5$, $x = 5$ or $x = -5$

$\downarrow$ div. $\qquad \downarrow$ conv.

$$\frac{1}{2}+\frac{1}{3}$$

$$-\frac{1}{2}+\frac{1}{3}-\frac{1}{4}+\frac{1}{5}-\cdots$$

$$\frac{x^2}{2^2+1}+\frac{x^3}{3^2+1}+\frac{x^4}{4^2+1}+\cdots+\frac{x^n}{n^2+1}+\frac{x^{n+1}}{(n+1)^2+1}+\cdots$$

$$\lim_{n\to\infty}\left[\frac{\cancel{x^{n+1}}\,x}{\underbrace{\cancel{n^2+2n+1+1}}_{1+\frac{2}{n}+2/n^2}}\cdot\frac{\overbrace{\cancel{n^2+1}}^{1+1/n^2}}{\cancel{x^n}}\right]=x$$

$|x|<1$ ser. conv. $\longrightarrow$ $-1 \leqq x \leqq 1$

$|x|>1$ ser. div.

$|x|=1$, $x=1$ $x=-1$.

$x=1$:

$$\frac{1}{2^2+1}+\frac{1}{3^2+1}+\frac{1}{4^2+1}+\cdots \quad \text{conv.}$$

$x=-1$:

$$\frac{1}{2^2+1}-\frac{1}{3^2+1}+\frac{1}{4^2+1}-\frac{1}{5^2+1}$$

Griffin 86),

$$y = 2.5x^2$$

$$\frac{dy}{dx} = 5x$$

$$dy = 5x\,dx$$

$$dx = 10.02 - 9.97 = \underline{0.05}$$

$$x = \underline{9.97}$$

$$dy = 5 \cdot (9.97) \cdot (0.05)$$

$$= \underline{2.4925} = \text{approximate increase}$$

$$y = 2.5x^2$$

$$y + \Delta y = 2.5(x + \Delta x)^2$$

$$\Delta y = 2.5(x^2 + 2x\Delta x + \Delta x^2) - 2.5x^2$$

$$\Delta y = 2.5x^2 + 5x\Delta x + 2.5\Delta x^2 - 2.5$$

$$\Delta y = 5x\Delta x + 2.5\Delta x^2$$

$$\Delta y = \underline{2.4925 + 0.00375}$$

$$= 2.49625 \quad \text{(Exact increase)}$$

Griffin 86/13

$$V = h\pi r^2$$

$$= h\pi\left(\frac{x}{2}\right)^2 = \frac{h\pi x^2}{4}$$

h is constant

$V = 62$ cu.ft. when $x = 20$ in.

1728 cu. in. = 1 cu. ft.

$$(1728)(62) = \frac{h\pi x^2}{4} = \frac{h\pi\, 400}{4} = h\pi\, 100$$

$$h = \frac{1728 \cdot 62}{100\pi}$$

$$\frac{dV}{dx} = \frac{h\pi x}{2}, \quad dV = \left(\frac{h\pi x}{2}\right) dx$$

When $\begin{cases} x = 30, \\ dx \pm .25 \end{cases}$

$$dV = \left(\frac{1728 \cdot 62}{100\pi} \cdot \frac{\pi}{2} \cdot 30 \cdot \frac{1}{4}\right) \text{cu. in.}$$

$$= \frac{\cancel{1728} \cdot \cancel{62}^{31}}{\cancel{100}\cancel{\pi}} \cdot \frac{\cancel{\pi}}{\cancel{2}} \cdot 3\cancel{0} \cdot \frac{1}{4} \cdot \frac{1}{\cancel{1728}} \text{ cu. ft.}$$

$$= \frac{93}{40} \text{ cu. ft.} = 2.325 \text{ cu. ft.}$$

∴ Volume is approx. 2.325 cu. ft. greater for $x = 30.25$ in. than for $x = 30$ in.

Griffin 93) 11

Perimeter = 10 ft.

Area of circle = πr^2

Area of 1/2 circle = $\dfrac{\pi r^2}{2}$

$r = \dfrac{b}{2}$ ✓

Area of semi-circle = $\dfrac{\pi b^2}{8}$ ✓

Total area = $\dfrac{\pi b^2}{8} + ab$

$A = \dfrac{\pi b^2}{8} + b(20 - \pi b - 2b)$

$A = \dfrac{\pi b^2}{8} + 20b - \pi b^2 - 2b^2$

$\dfrac{dA}{db} = \dfrac{\pi}{4}b + 20 - 2\pi b - 4b$

$= \dfrac{\pi b + 80 - 8\pi b - 16b}{4}$

$= \dfrac{80 - 7\pi b - 16b}{4}$

Setting $\dfrac{dA}{db} = 0$,

$7\pi b + 16b = 80$

$b(7\pi + 16) = 80$

$b = \dfrac{80}{7\pi + 16} = 2.1$

a =

Circumference of Circle $= 2\pi r$

" " Semi " $= \pi r$

$= \dfrac{\pi b}{2}$

Total Circumference (Perimeter) $= \dfrac{\pi b}{2} + b + 2a$

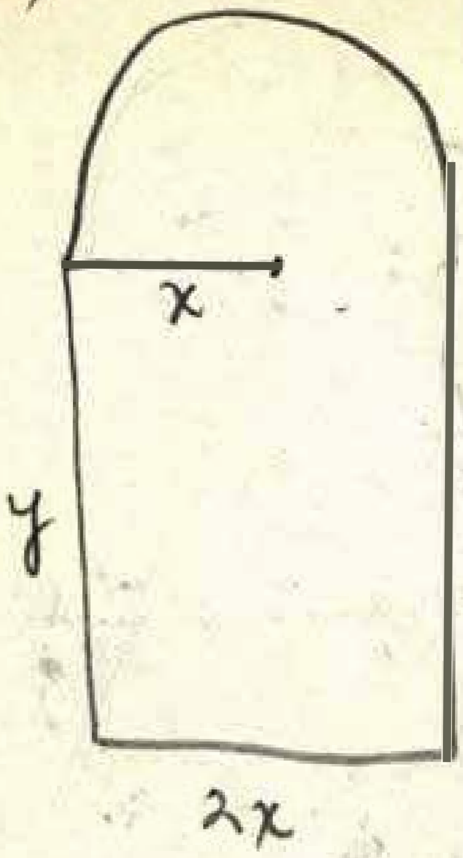
$P = 10 = \dfrac{\pi b}{2} + b + 2a$

$2a = 10 - \dfrac{\pi b}{2} - b = \dfrac{20 - \pi b - 2b}{2}$

$a = 20 - \pi b - 2b$

greatest area when $b \doteq 2.3$ ft. (+ a = 8.2 ft.)

93) 11 Griffin



$$C = 2\pi r = 2\pi x$$

$$\frac{C}{2} = \pi x$$

$$P = \pi x + 2x + 2y$$

$$10 = \pi x + 2x + 2y$$

$$2y = 10 - \pi x - 2x$$

$$y = \frac{10 - \pi x - 2x}{2}$$

Area of Circle $= \pi r^2 = \pi x^2$

Area of Semicircle $= \frac{\pi x^2}{2}$

Total Area of Window $= \frac{\pi x^2}{2} + 2xy$

$$A = \frac{\pi x^2}{2} + \cancel{2}x\left(\frac{10 - \pi x - 2x}{\cancel{2}}\right)$$

$$A = \frac{\pi x^2}{2} + 10x - \pi x^2 - 2x^2$$

$$\frac{dA}{dx} = \pi x + 10 - 2\pi x - 4x$$

$$= 10 - \pi x - 4x$$

Setting $\frac{dA}{dx} = 0$,

$$10 - \pi x - 4x = 0$$

$$\pi x + 4x = 10$$

$$x(\pi + 4) = 10$$

$$x = \frac{10}{\pi + 4} = 1.4 \text{ ft.}$$

$$2x = 2.8 \text{ ft.}$$

$$y = \frac{10 - 1.4\pi - 2.8}{2} = 1.4 \text{ ft.}$$

$\therefore$ greatest area when base $= 2.8$ ft.
side $= 1.4$ ft.

x	dA/dx
> 1.4	$-$
1.4	0
< 1.4	$+$

99) 9

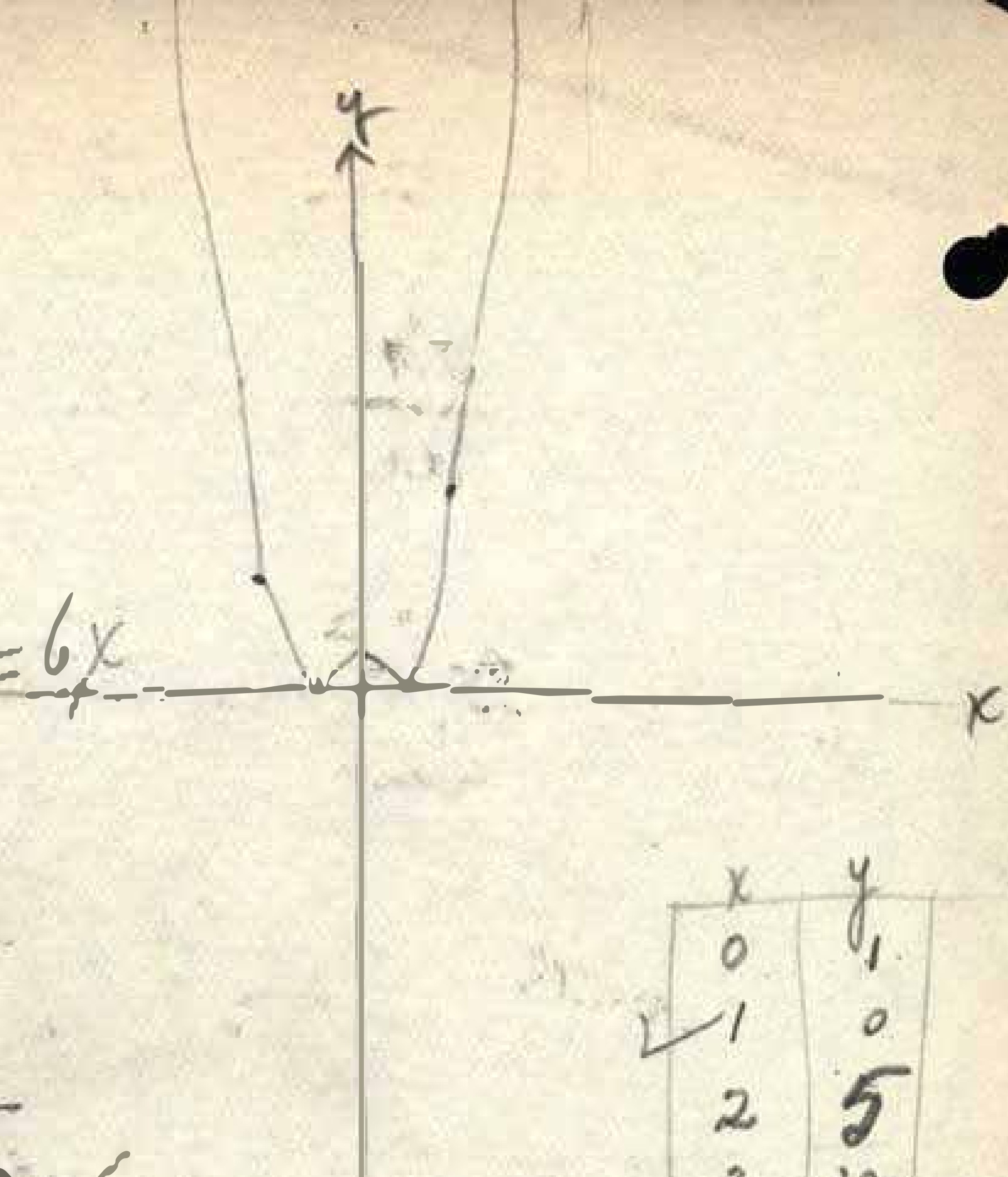
$y = x^3 - 2x + 1$

$m = y' = \text{slope} = 3x^2 - 2$ ✓

$m' = y'' = 6x$

at $x = 2$, $y'' = 12$ ✓

$\frac{dm}{dx} = 6x$



x	y
0	1
✓1	0
2	5
3	22
✗−1	0
−2	−3
−3	−20

at $x = 1.99$, slope $= 9.8803$

$x = 2.01$, slope $= 10.1203$

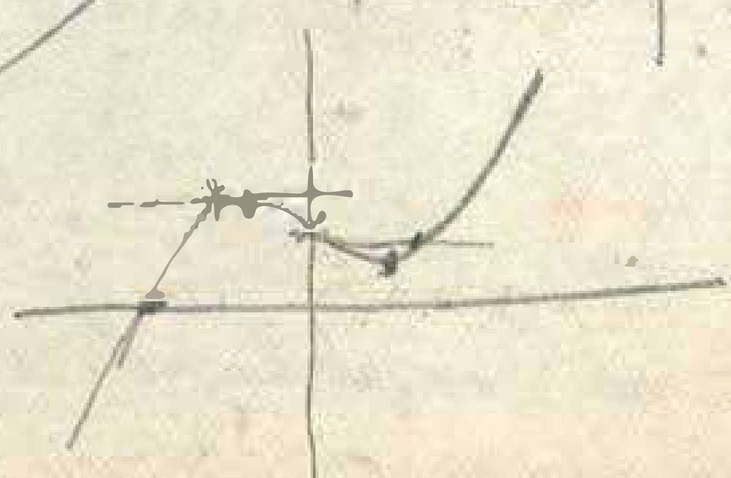
Difference $= 0.24000$ ✓

for 0.02 units of x

then for 0.01 unit of x, $\Delta y' = 0.12$ ✓

And for 1 unit of x, $\Delta y' = 12$ $(= y'')$ ✓

$\frac{dy}{dx} = 3x^2 - 2$



$3x^2 - 2 = 0$

$x^2 = 2/3$

$x = \pm\sqrt{2/3}$

$y = \sqrt{8/27} + 2\sqrt{2/3} + 1$

102) 6

$$E = 100t^4 - 20t^5 + t^6$$

$$\frac{dE}{dt} = 400t^3 - 100t^4 + 6t^5$$

$$\frac{d}{dt}\left(\frac{dE}{dt}\right) = \frac{d^2E}{dt^2} = 1200t^2 - 400t^3 + 30t^4$$

Setting $\frac{d^2E}{dt^2} = 0$, $1200t^2 - 400t^3 + 30t^4 = 0$

$$120t^2 - 40t^3 + 3t^4 = 0$$

$$t^2(120 - 40t + 3t^2) = 0$$

$$\underline{\underline{t = 0}}$$

$$3t^2 - 40t + 120 = 0$$

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

$a = 3$
$b = -40$
$c = 120$

$$t = \frac{40 \pm \sqrt{1600 - 1440}}{6}$$

$$t = \frac{40 \pm \sqrt{160}}{6} = \frac{40 \pm 4\sqrt{10}}{6}$$

$$t = \frac{20 \pm 2\sqrt{10}}{3} = \frac{20 + 6.32}{3} \text{ or } \frac{20 - 6.32}{3}$$

$$= 8.77 \text{ or } 5.23$$

t	$\frac{d^2E}{dt^2}$
> 8.77	+
8.77	0
$< 8.77, > 5.23$	−
5.23	0
$< 5.23, > 0$	+
0	0
$t < 0$	+

$t < 0$	+
$5.23 > t > 0$	+
$8.77 > t > 5.23$	−
$t > 8.77$	+

∴ E was changing most rapidly when

$t = \cancel{0}, \underline{5.23}, \cancel{8.77}$

most rapid

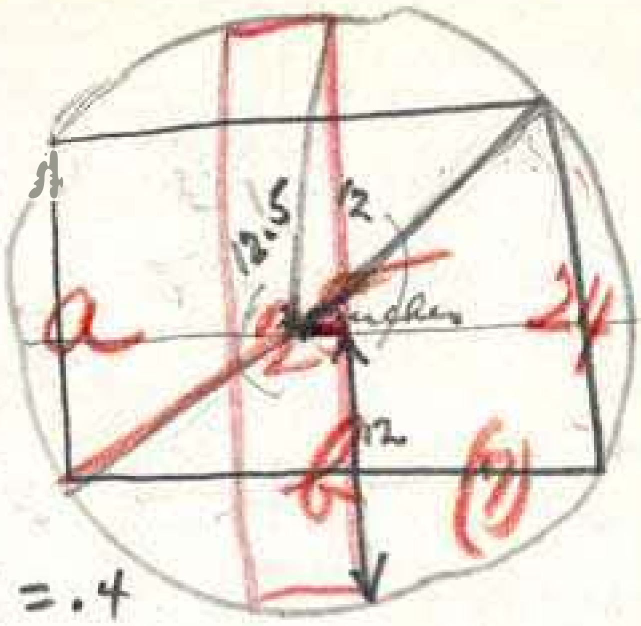
111) 11

Given $\dfrac{db}{dt} = .4$ ✓

Area of rectangle $= b \times a$

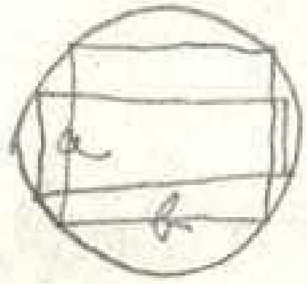
Area of circle $= \pi r^2 = 25\pi$

Area of rectangle approaches 25π as limit

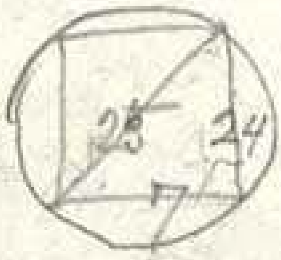


When altitude = 24 inches, $\dfrac{db}{dt} = .4$

and $A = 24\cancel{b}$



$$\frac{dA}{dt} = 24\frac{db}{dt} = 24(.4) = 9.6$$



✓ $\cancel{A = ab}$

✓ $\cancel{\dfrac{dA}{dt} = a\dfrac{db}{dt} + b\dfrac{da}{dt}}$

$\cancel{9.6 = 24(0.4) + 6.5\dfrac{da}{dt}}$

$\cancel{\dfrac{da}{dt} = \dfrac{9.6 - 9.6}{}}$

radius = 12.5 inches

when $a = 24$,

$b = 2\sqrt{(12.5)^2 - (12)^2}$

$b = 2\sqrt{12.25} = \cancel{6.5}$ 7

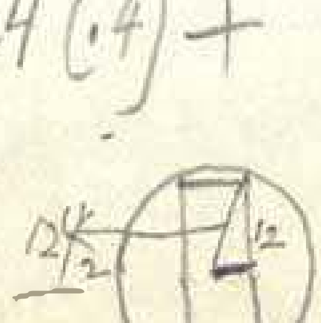
$a = \dfrac{A}{b} = \dfrac{A}{6.5}$

$\dfrac{da}{dt} = \dfrac{1}{6.5}\dfrac{dA}{dt} = \dfrac{9.6}{6.5}$

$= 1.48$

$\therefore$ altitude is decreasing at rate of 1.48 in / min.

$\dfrac{dA}{dt} = 24(.4) + 7$



117) 5

$$Q = \frac{c}{(1+kt)}$$

$$\frac{dQ}{dt} = \frac{d}{dt}\ \frac{c}{(1+kt)}$$

$$= \frac{d}{dt}\ c(1+kt)^{-1}$$

$$= -c(1+kt)^{-2}k$$

$$dQ/dt = \frac{-ck}{(1+kt)^2}$$

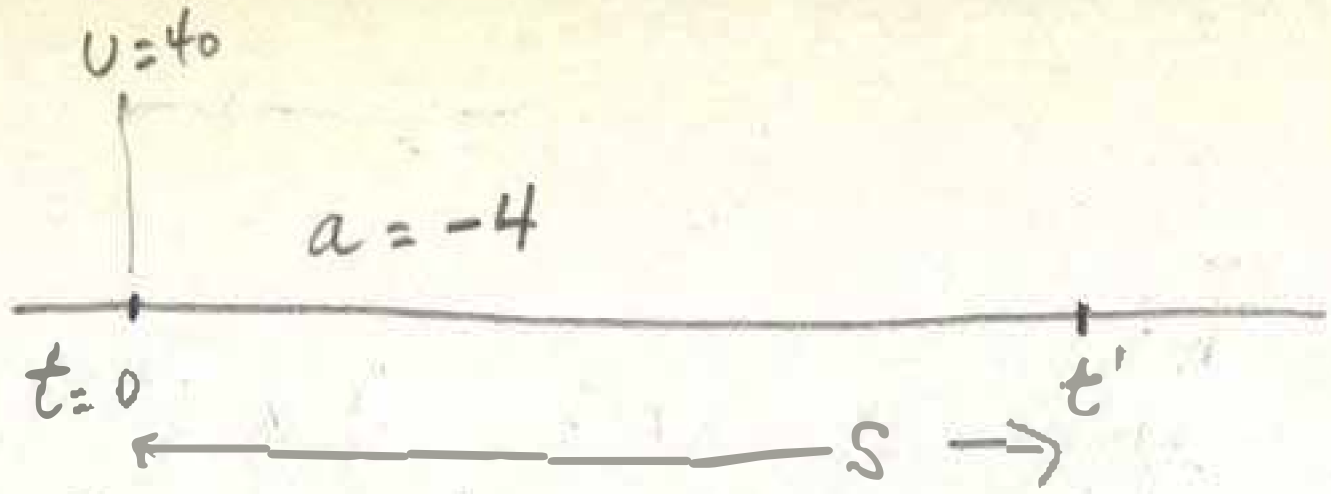
if $Q = \dfrac{c}{(1+kt)}$, $(1+kt) = \dfrac{c}{Q}$,

$$\frac{dQ}{dt} \quad Q^2 = \frac{c^2}{(1+kt)^2} \quad \& \quad (1+kt)^2 = \frac{c^2}{Q^2}$$

$$dQ/dt = \frac{-k}{c}Q^2$$

Then $\dfrac{dQ}{dt} = \dfrac{-ck}{\frac{c^2}{Q^2}} = \dfrac{-ck}{c^2} \cdot Q^2 = \underline{\underline{-\dfrac{k}{c} \cdot Q^2}}$

126) 10



$a = -4$ $\quad \frac{dv}{dt} = a$

$v = \int(-4)\,dt$

① $v = -4t + C$

When $t = 0$, $v = 40$

$\therefore 40 = -4t + C$

$\therefore C = 40$

Substituting in ①,

$v = -4t + 40$

$s = \int v\,dt = \int(-4t+40)\,dt$

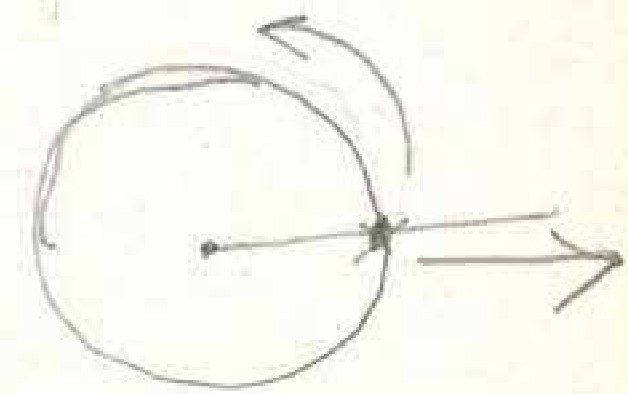
$s = -2t^2 + 40t + C$

When $t = 0$, $s = 0$,

$\therefore 0 = 0 + 0 + C$

$C = 0$

$\therefore s = -2t^2 + 40t$



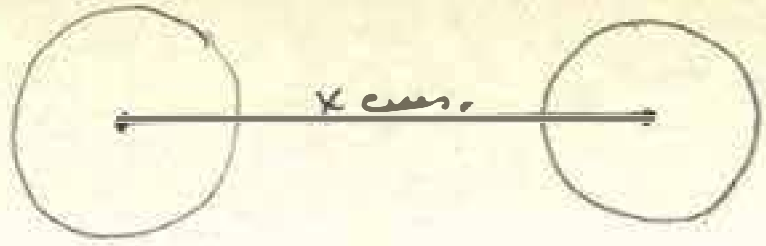
Since initial speed was 40 in/sec, & speed decreased at rate of 4 in/sec², it required 10 seconds for point to stop.

Stops when $v=0$

$\therefore s = -200 + 400$

$= 200$ inches

Griffin (132) 4



$$F = \frac{20}{x^2}$$

$$\int_2^{10} F\,dx = \int_2^{10}\left(\frac{20}{x^2}\right)dx = 20\int_2^{10}\left(\cancel{20}\,x^{-2}\right)dx = \cancel{\frac{-40x^{-1}}{-1}}\Bigg]_2^{10}$$

$$= -20x^{-1}\Big]_2^{10} = -\frac{20}{x}\Big]_2^{10}$$

$$= \frac{40}{x}\Big]_2^{10} = \frac{40}{10} - \cancel{\frac{40}{2} = 4 - 20 = -16}$$

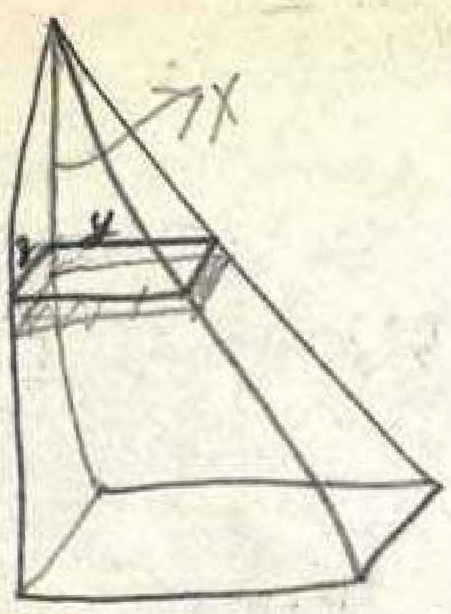
$$= -2 - (-10) = 8$$

dyne-cm.

$$\cancel{\int_2^{1000}\left(\frac{20}{x^2}\right)dx = \frac{40}{x}\Big]_2^{1000}} = \frac{40}{1000} - \frac{40}{2} = \frac{1}{25} - 20 = -19\frac{4}{5}$$

$$-\frac{20}{x}\Big]_2^{1000}$$

133) 9



Element of Volume $= (yz)\,dx$

Total Volume $= \int (yz)\,dx$

$$y = 14\sqrt{x}$$

$$z = \frac{x^2}{3}$$

Then Total Volume from $x = 0$ to $x = 16$

$$= \int_0^{16} (yz)\,dx = \int_0^{16} \left(14\sqrt{x} \cdot \frac{x^2}{3}\right) dx$$

$$= \frac{14}{3} \int_0^{16} \left(\frac{x^{5/2}}{\cancel{3}}\right) dx = \cancel{14\left(\frac{\frac{3}{2}x^{\frac{5}{2}}}{3\cdot\frac{5}{2}}\right)}\Bigg]_0^{16}$$

$$\left(\sqrt{16}\right)^7$$

$$= \cancel{\frac{14\,x^{\frac{5}{2}}}{5}}\Bigg]_0^{16} \qquad \frac{\overset{2}{\cancel{14}}}{3} \cdot x^{7/2} \cdot \frac{2}{\cancel{7}}\Bigg]_0^{16}$$

$$\frac{4}{3} x^{7/2}\Bigg]_0^{16} = \frac{4}{3} \cdot 4^7$$

$$\cancel{= \frac{14 \cdot 16^2 \cdot \sqrt{16}}{5} = \frac{14 \cdot 256 \cdot 4}{5} = 2867.7 \text{ cu. units}}$$

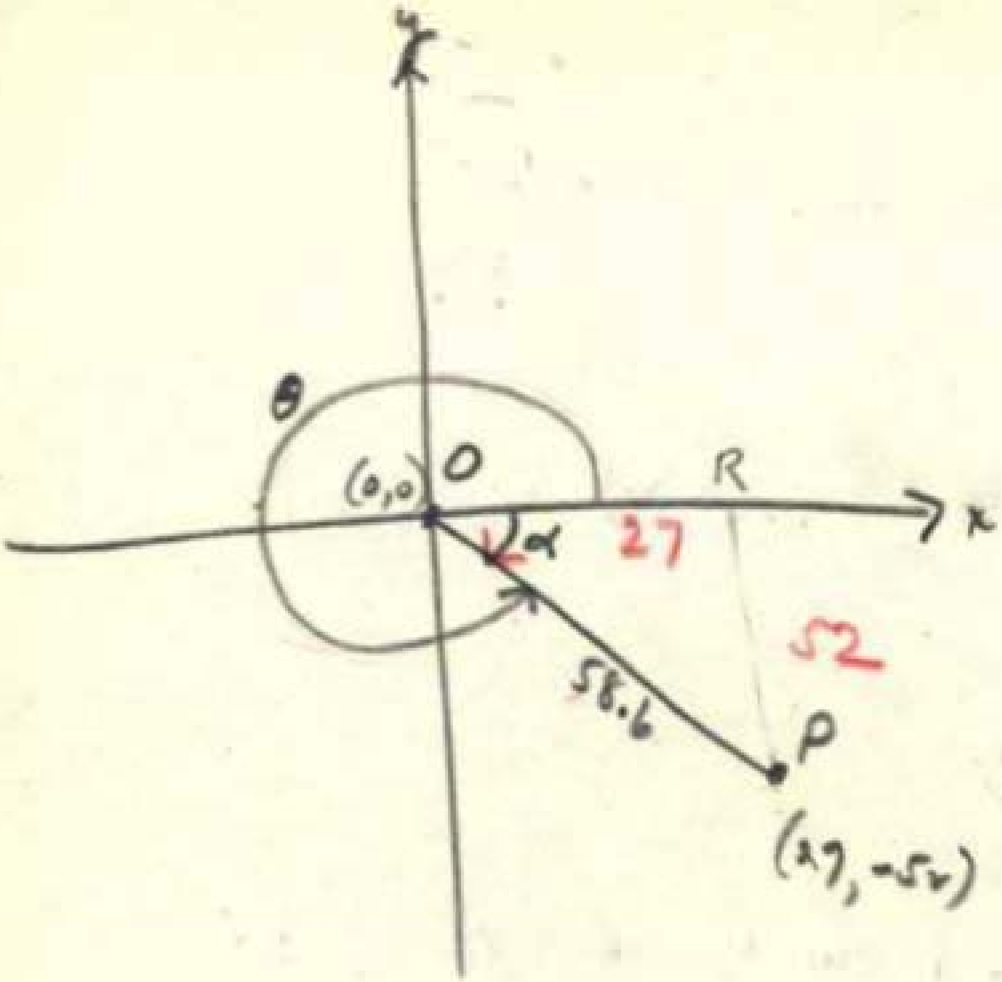
Griffin
150)7

$$OP = \sqrt{27^2 + (-52)^2}$$

$$= \sqrt{729 + 2704}$$

$$= \sqrt{3433}$$

$$= 58.6 \text{ miles}$$



$$\cos\alpha = \frac{27}{58.6} = .46$$

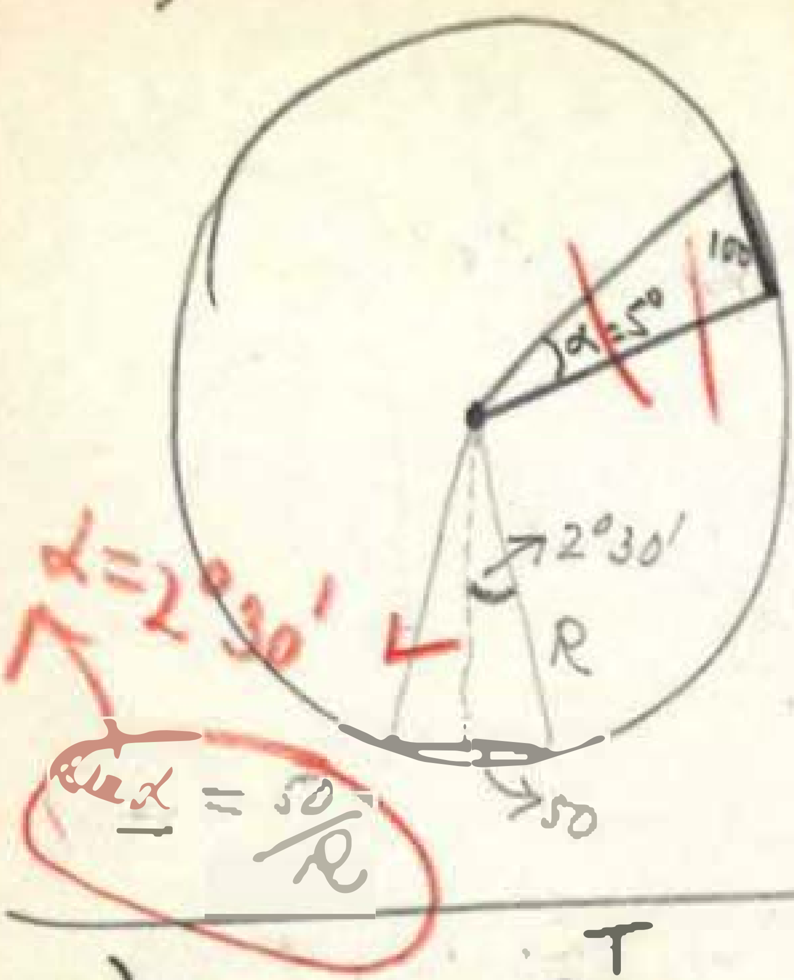
$$\therefore \alpha = 62°24'$$

and $\theta = 360° - 62°24'$

$$= 297°36'$$

$\tan\alpha = \frac{52}{27} = \ldots\ldots$

165) 4a



$\alpha = 5^\circ$

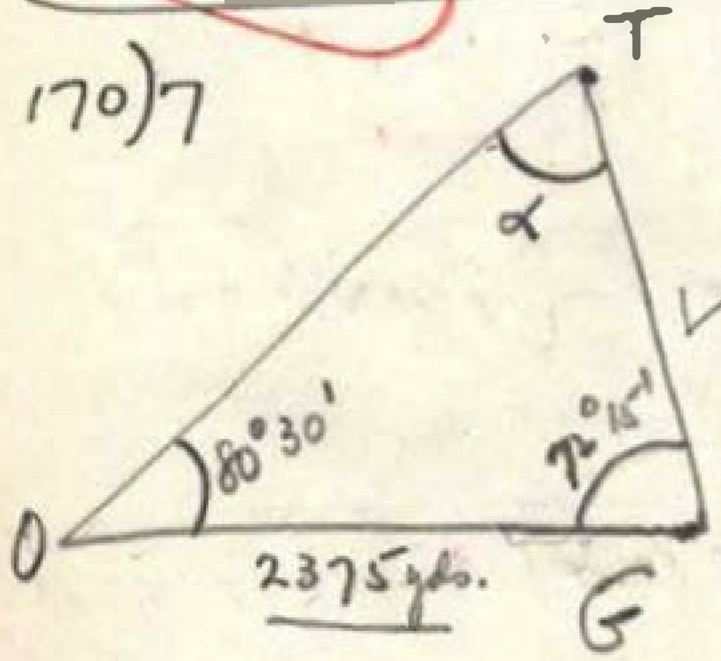
$\cancel{\sin\alpha = \frac{100}{r}}$

$\cancel{.08716 = \frac{100}{r}}$

$r = \frac{100}{.08716} = 1147.3$ ft.

---

170) 7



Sine Law — $\frac{a}{\sin a} = \frac{b}{\sin b} = \frac{c}{\sin c}$

$\alpha = 180^\circ - (80^\circ 30' + 72^\circ 15') = 27^\circ 15'$

$\frac{2375}{.45787} = \frac{GT}{.98629}$

$GT = \frac{2375 \times .98629}{.45787} = 5246.9$ yds.

$\log 2375 = 3.37566$

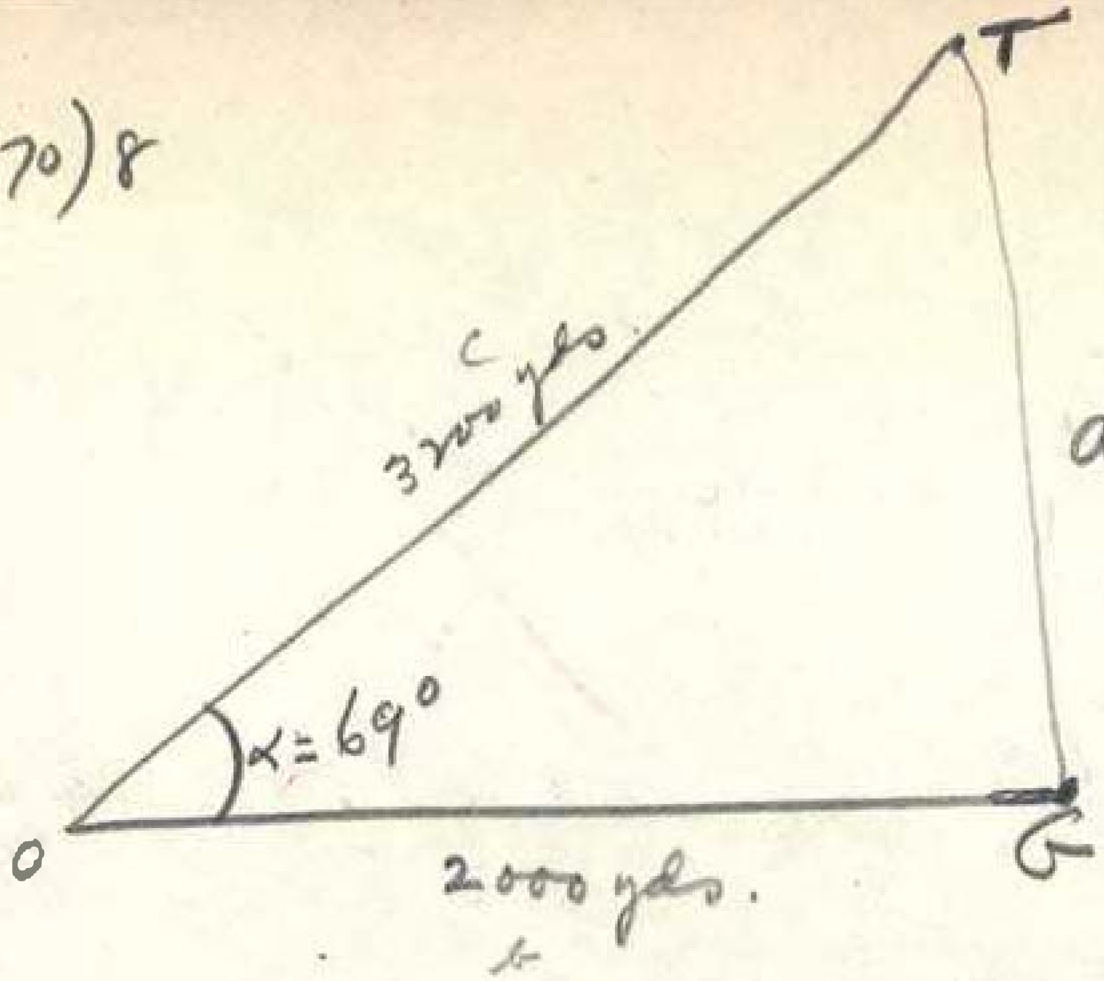
$\log .98629 = 9.99400 - 10$

$13.36966 - 10$

$\log .45787 = 9.65074 - 10$

3.71992

170) 8



$a = 3106$ yds.

Law of Cosines $\quad a^2 = b^2 + c^2 - \underbrace{2bc\cos\alpha}$

$$a = \sqrt{(2000)^2 + (3200)^2 - [(2)(2000)(3200)(.35837)]}$$

$$= \sqrt{4000000 + 10240000 - (4587136)}$$

$$= 3106 \text{ yds}$$

---

212) 1a

$$2^x = 7$$

$$x \log 2 = \log 7$$

$$x = \frac{\log 7}{\log 2} = \frac{.84510}{.30103} = 2.8$$

$$\begin{array}{r} 2.8 \\ .30103\overline{)\,.84510} \\ .60206 \\ \hline 24304.0 \end{array}$$

225) 6

\$3800 after 30 yrs. Interest at 6%, cpd. quarterly

$$A = P\left(1 + \frac{r}{k}\right)^{kn}$$

6%

$1\frac{1}{2}\%$

A = amount

P = principal

r = ~~interest~~ rate = .06

k = no. times cpd. annually = 4

n = number of years

Kn = 120

$r = .06$

$K = 4$

$\frac{r}{K} = .015$

$$A = 3800\cancel{\left(1 + \frac{.06}{30}\right)^{\cancel{180}\,120}} = 3800(1.015)^{120}$$

$$= 3800\,(1 + .002)^{180}$$

$$= \$5706.6$$

$\text{Log } 1.\cancel{002}\,015 = .00087$

$\times \cancel{180}$

006960

00087

.15660

3.59978

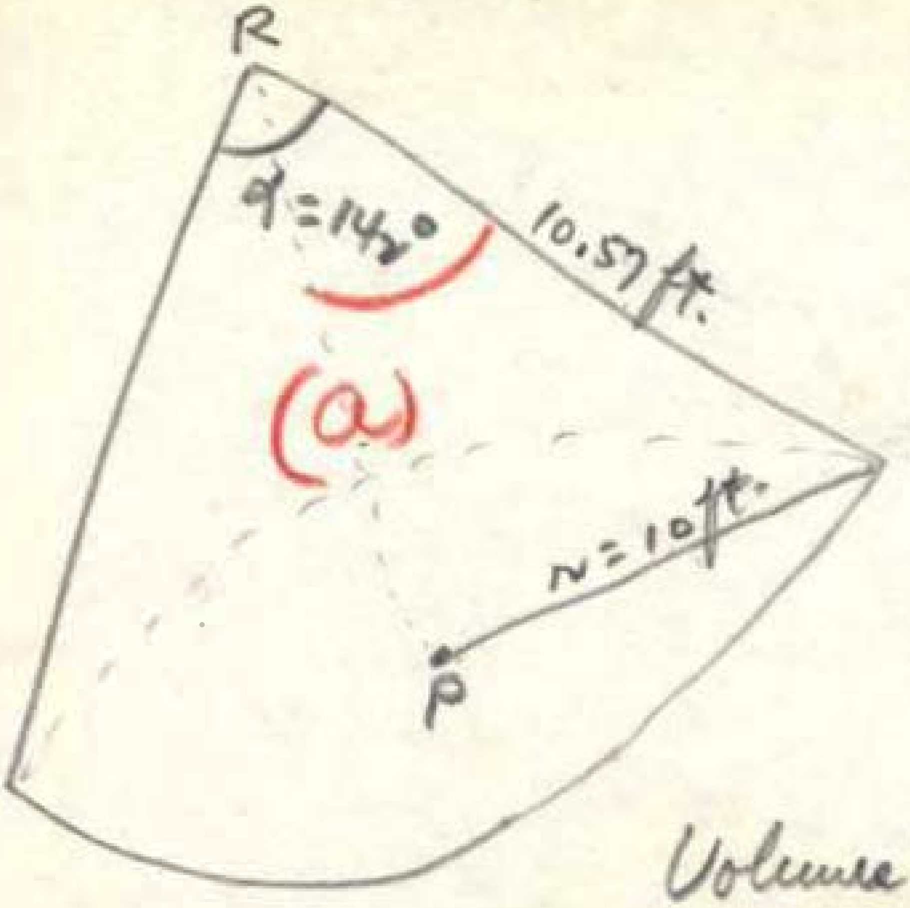
Log 3800 = 3.75638

X

Griffin

228) 15

Perpendicular RP bisects α



$\cancel{\sin}\ \tan 71° = \dfrac{10}{\cancel{RS}\ a}$

$a\ \cancel{RS} = \dfrac{10}{\cancel{\sin}\ \tan 71°} = \dfrac{10}{.94552}$

$RS = 10.57$ ft.

(when $r = 10$ ft.)

Volume of Cone $= \frac{1}{3}\pi r^2 a$

Since α is constant, a always $= \dfrac{10.57r}{10}$

$= 1.057r$

$V = \frac{1}{3}\pi r^2 \cdot 1.057r$ $\qquad \dfrac{dv}{dt} = 3$

$V = \frac{1}{3}\pi r^3 (1.057) = 0.3523\pi r^3$ $\qquad \dfrac{dr}{dt} = ?$

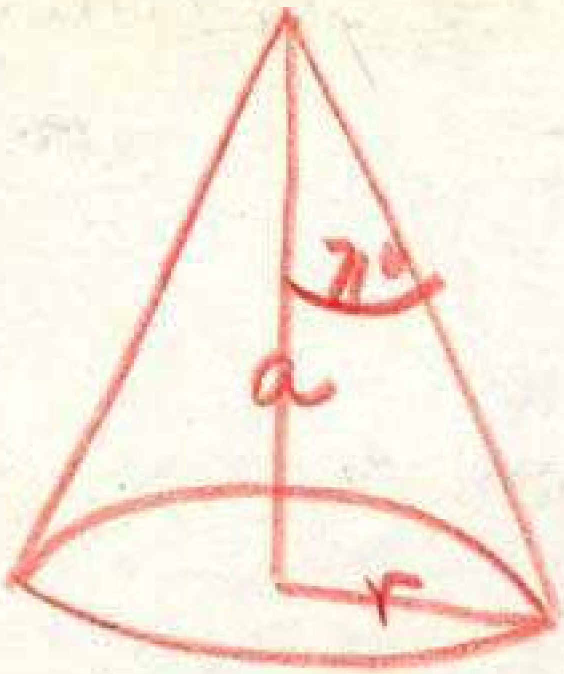
$$\frac{dV}{dt} = 1.057\pi r^2 \frac{dr}{dt}$$

But $\dfrac{dV}{dt}$ is given as 3 cu. ft. per min. when $r = 10$

$\therefore\ 3 = 1.057\pi\, 100 \dfrac{dr}{dt}$

$$\frac{dr}{dt} = \frac{3}{(1.05)\,100\pi} = \frac{1}{35\pi}$$

$\therefore$ radius is increasing at rate of $\dfrac{1}{3.5\pi}$ ft./min



$\log_b a = c$

$a = b^c$

$V =$

$\cancel{\frac{35.8}{100}}$

$\ln Q - \ln 200 = -.38t$

$\ln_e\left(\frac{Q}{200}\right) = -.38t$

$\frac{Q}{200} = e^{-.38t}$, $Q = 200e^{-.38t}$

$t = 50$, $\underline{Q = 200e^{-19}}$

Griffin (237) 7

5000 years = 50 centuries

Rate of decomposition of Radium = 3.8%

Original amount = P = 200 mgms.

$$Q = Pe^{rn}$$

$$= 200 \cdot e^{-\cancel{.98}\ .38 \times 50}$$

$$= 200 \cdot e^{-4.0}$$

$$= \frac{200}{e^4}$$

$\cancel{\int dQ = \int -.38\, Q\, dt}$

= 3.6632 mgms. ~~of radium are left~~

Q = am. rad.

$$\frac{dQ}{dt} = \frac{-3.8}{100} Q$$

$$\frac{dQ}{dt} = -.38\, Q$$

(1) $$\int \frac{dQ}{Q} = \int_0^{50} -.38\, dt$$

$\log e = .43429$

$\log e^4 = 1.73716$

$\log 200 = 2.30103$

$$\begin{array}{r} 2.30103 \\ 1.73716 \\ \hline .56387 \end{array}$$

$$\int \frac{dQ}{Q} = \int -.38\, dt$$

$$\ln Q = -.38t + C$$

$$\ln 200 = \qquad + C$$

$$\ln Q = -.38t + \ln 200$$

~~Q~~ $t = 0,\ Q = 200$

Griffin 266) 7

$$PV = 500T$$

$$P\frac{dV}{dt} + V\frac{dP}{dt} = 500\frac{dT}{dt}$$

Given $P = 60$ ✓

$V = 6000$ ✓

$$\left.\begin{aligned}\frac{dP}{dt} &= .04 \\ \frac{dV}{dt} &= -2\end{aligned}\right\}$$

then $$\frac{dT}{dt} = \frac{60(-2) + 6000(0.4)}{500}$$

$$= \frac{-120 + 2400}{500}$$

$$= \frac{2280}{500}$$

$$= 4.56$$ ✓

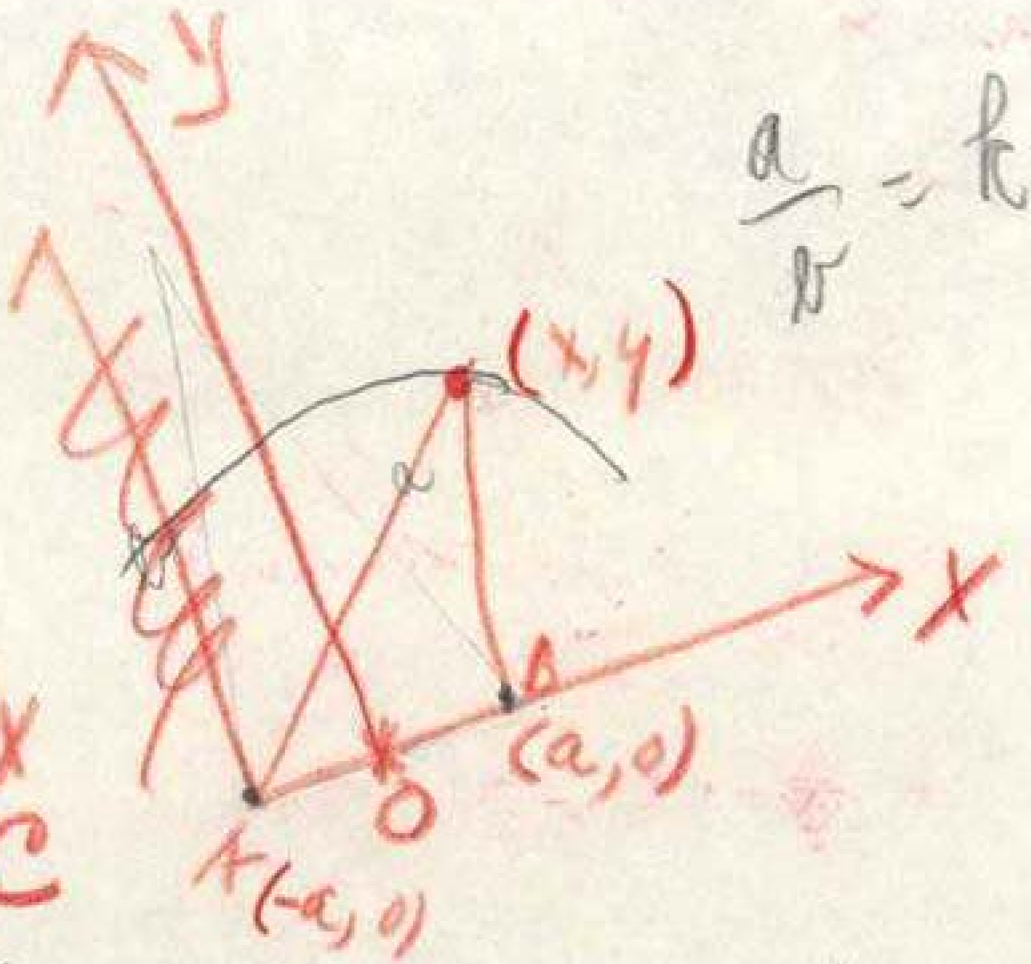
$\therefore$ T is changing at rate $\frac{4.56 \text{ units}}{\text{sec}}$.

(increasing)

4.56
50) 228
200
280
250
300

289/7 290/16

$\frac{1}{u}\Big]_1^{\infty} = 0 - 1 = -1$



$\frac{a}{b} = k$

$Ax^2 + Ay^2 + Bx = C$

$x^2 + Kx + \frac{K^2}{4} + y^2 = L + \frac{K^2}{4}$

$-2ax \quad -2ak^2x$

$(x+\frac{K}{2})^2 + y^2 = con.$

$$\frac{\sqrt{(x-a)^2 + (y)^2}}{\sqrt{(x+a)^2 + y^2}} = k$$

$$\sqrt{(x-a)^2 + y^2} = k\sqrt{(x+a)^2 + y^2}$$

$$(x-a)^2 + y^2 = k^2\left[(x+a)^2 + y^2\right]$$

$$\frac{x^2 - 2ax + a^2 + y^2}{x^2 + 2ax + a^2 + y^2} = k^2$$

$x^2 - 2ax + a^2 + y^2 = k^2x^2 + 2ak^2x + k^2a^2 + k^2y^2$

$x^2(1-k^2) + y^2(1-k^2) - 2x(a+k^2) = a^2(k^2-1)$

438) 3

$$\frac{x}{1\cdot 3}+\frac{x^3}{3\cdot 3^3}+\frac{x^5}{5\cdot 3^5}+\cdots+\frac{x^{2n-1}}{(2n-1)(3^{2n-1})}+\frac{x^{2n+1}}{(2n+1)\cdot 3^{2n+1}}+\cdots$$

$$\lim_{n\to\infty}\left[\frac{\cancel{x^{2n+1}}\,x^2}{\cancel{(2n+1)}\,(2+1/n)\cdot \cancel{3^{2n+1}}\,3^2}\cdot\frac{\cancel{(2n-1)}\,(2-1/n)\cdot\cancel{3^{2n-1}}}{\cancel{x^{2n-1}}}\right]=\frac{2x^2}{2\cdot 9}=x^2/9$$

Ser. conv. $x^2/9<1$, $x^2<9$, $|x|<3$, $-3<x<3$

Ser. div. $x^2/9>1$, $x^2>9$ $|x|>3$

$x=3$ ser. div. }
$x=-3$, ser. div. }

$$x=3\rightarrow \frac{3}{1.3}+\frac{27}{3.27}+\frac{1}{5}+\cdots$$

$$=\pm 1\pm\frac{1}{3}\pm\frac{1}{5}\pm\frac{1}{7}+\cdots\pm\frac{1}{2n-1}+\cdots$$

$\cancel{1+1/3}$

$\cancel{1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}+\frac{1}{6}}$

$u=2n-1$
$du=2\,dn$
$\frac{1}{2}du=dn$

$$\int_1^\infty \frac{1}{2n-1}\,dn$$

$$=\frac{1}{2}\int_1^\infty \frac{1}{u}\,du$$

$$=\frac{1}{2}\ln u\Big]_1^\infty$$

~~It~~ does not have a value

$\therefore$ ser. div.

$f(t)$ $\longrightarrow$

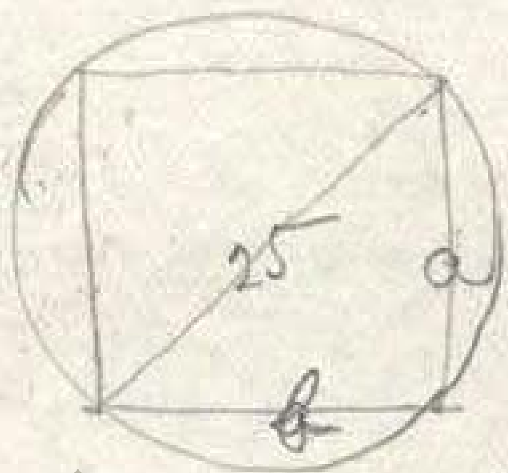
$f'(t)=0$ $\quad t=a, b, c$

	$f'(t)$
$t<a$	$+$
$b>t>a$	$+$
$c>t>b$	$-$
$t>c$	$+$

at $t=a$, no max. or min. value for $f(t)$

at $t=b$, $f(t)$ has max. value

at $t=c$, $f(t)$ has a min. value.

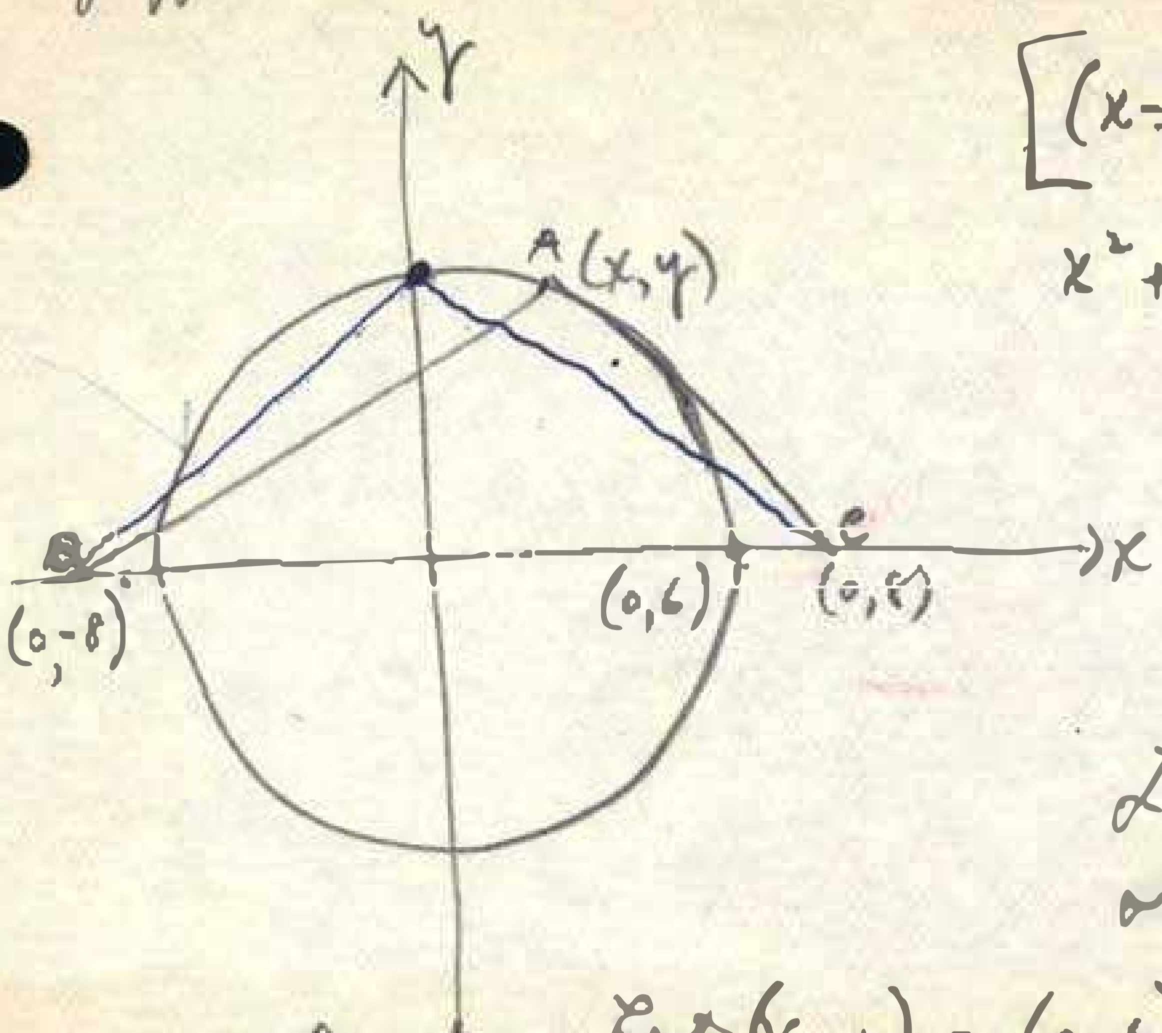


$a^2+b^2=625$

$\cancel{2}a\frac{da}{dt}+\cancel{2}b\frac{db}{dt}=0$

$24\frac{da}{dt}+7(0.4)$

Griffin 289) 7



$\overline{AB}^2 + \overline{AC}^2 = 200$

$\left[(x-0)^2+(y+8)^2\right]+\left[(x-0)^2+(y-8)^2\right] = 200$

$x^2+y^2+16y+64+x^2+y^2-16y+64 = 200$

$2x^2+2y^2+128 = 200$

$x^2+y^2+64 = 100$

$x^2+y^2 = 36$

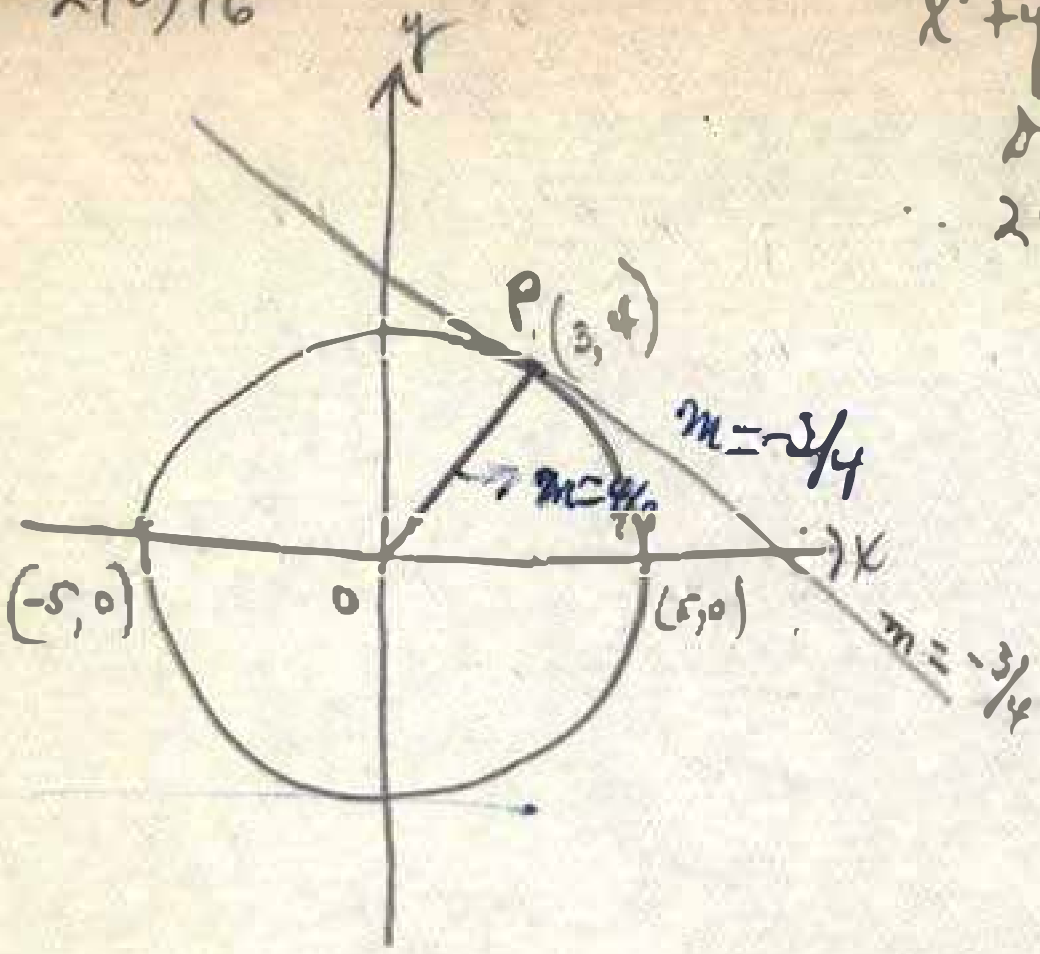
Locus is circle with center at origin & radius = 6

Check Let $(x, y) = (0, 6)$

Then $\left[0+(6-8)^2\right]+\left[0+(6+8)^2\right] = 200$

$4 + 196 = 200$ Q.E.D.

290) 16



$x^2+y^2=25$ (circle : center at origin & r = 5)

Differentiating, (let m = slope)

∴ $2x + 2y\frac{dy}{dx} = 0$; $\frac{dy}{dx} = -\frac{2x}{2y} = -\frac{x}{y}$

At (3,4); $m = -\frac{3}{4}$

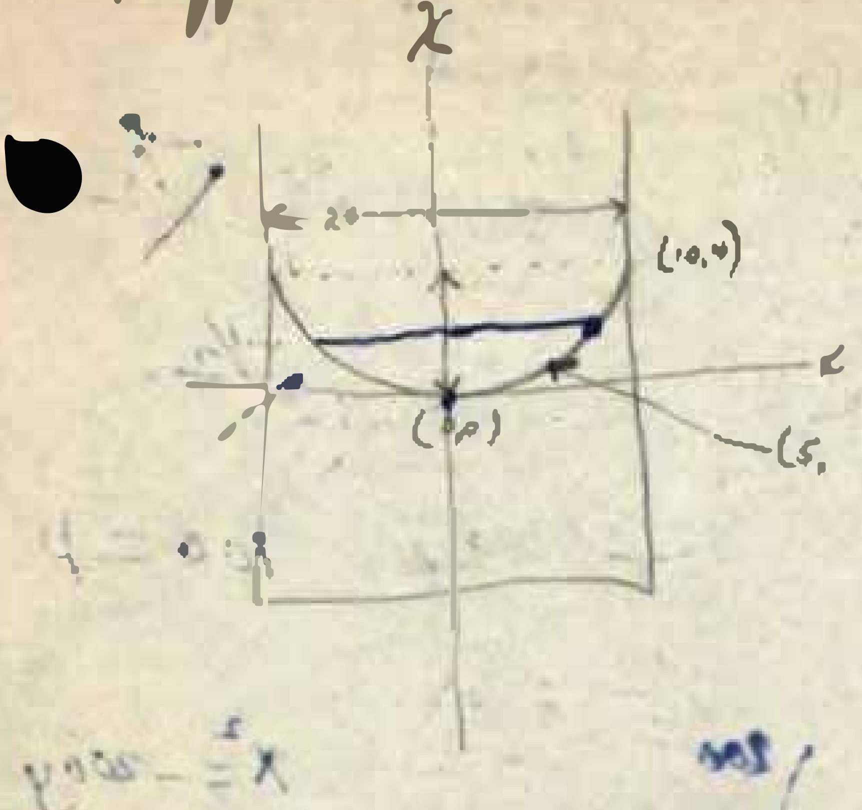
Let OP be radius drawn to (3,4)

The m of OP $= \frac{y_2-y_1}{x_2-x_1} = \frac{4-0}{3-0} = \frac{4}{3}$

m of OP is negative reciprocal of m of tangent

This ~~proves~~ verifies that the radius drawn to point of tangency is perpendicular to the tangent at that point since their slopes are negatively reciprocal to each other, (the test of perpendicularity).

Griffin 295) 7



Vertex of Parabola at (0,0)

Parabola is of type $x^2 = 2py$,

and where $y = 4$ when $x = 10$,

$100 = 2p(4)$

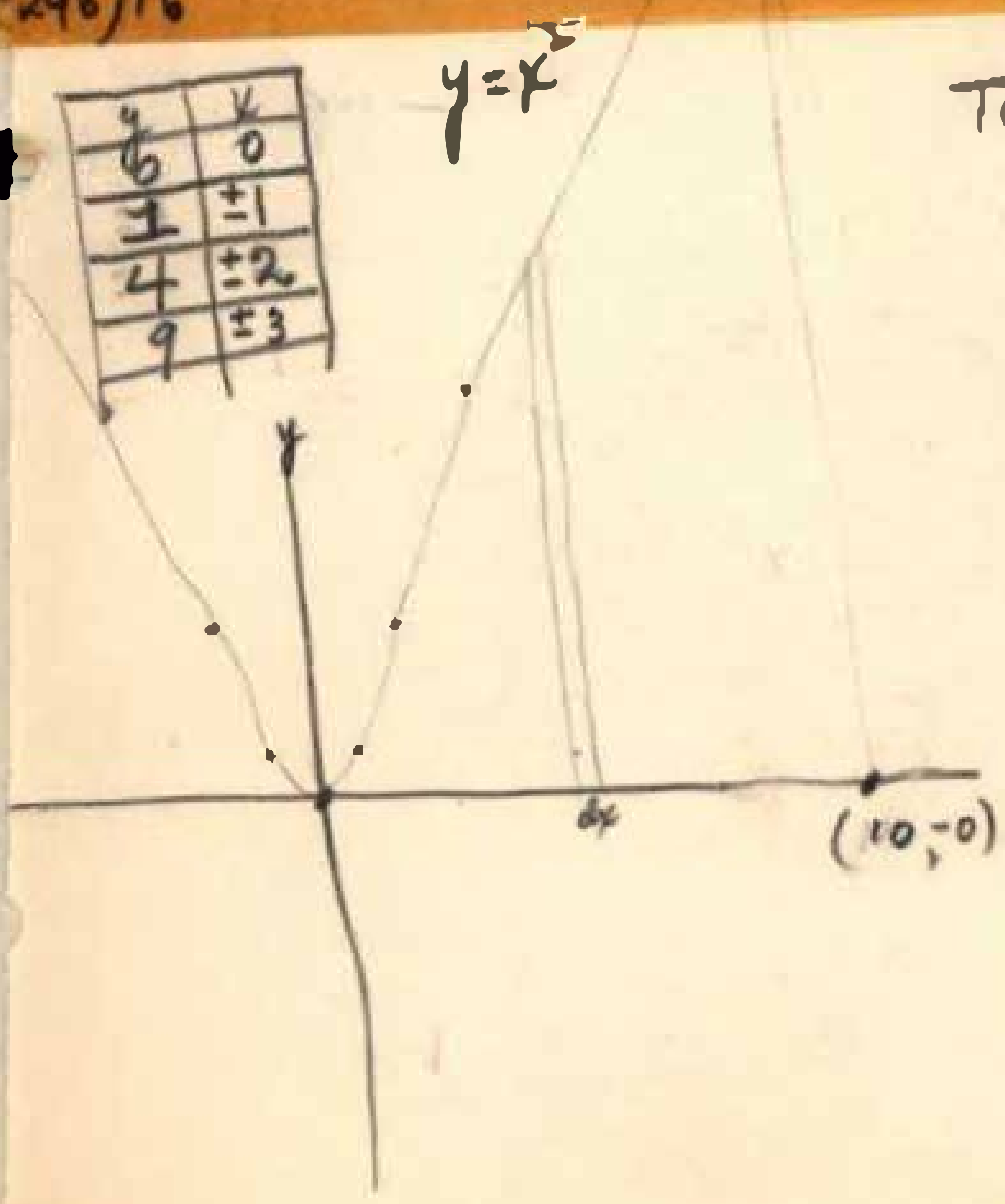
$2p = 25$

$\therefore x^2 = 25y$

when $x = 5$, $25 = 25y$

$y = 1$

296) 16



y	x
0	0
1	±1
4	±2
9	±3

Element of area $= y\,dx$

Total area $= \int_0^{10} x^2\,dx = \dfrac{x^3}{3}\Big]_0^{10}$

$= \dfrac{1000}{3} = 333\tfrac{1}{3}$ units

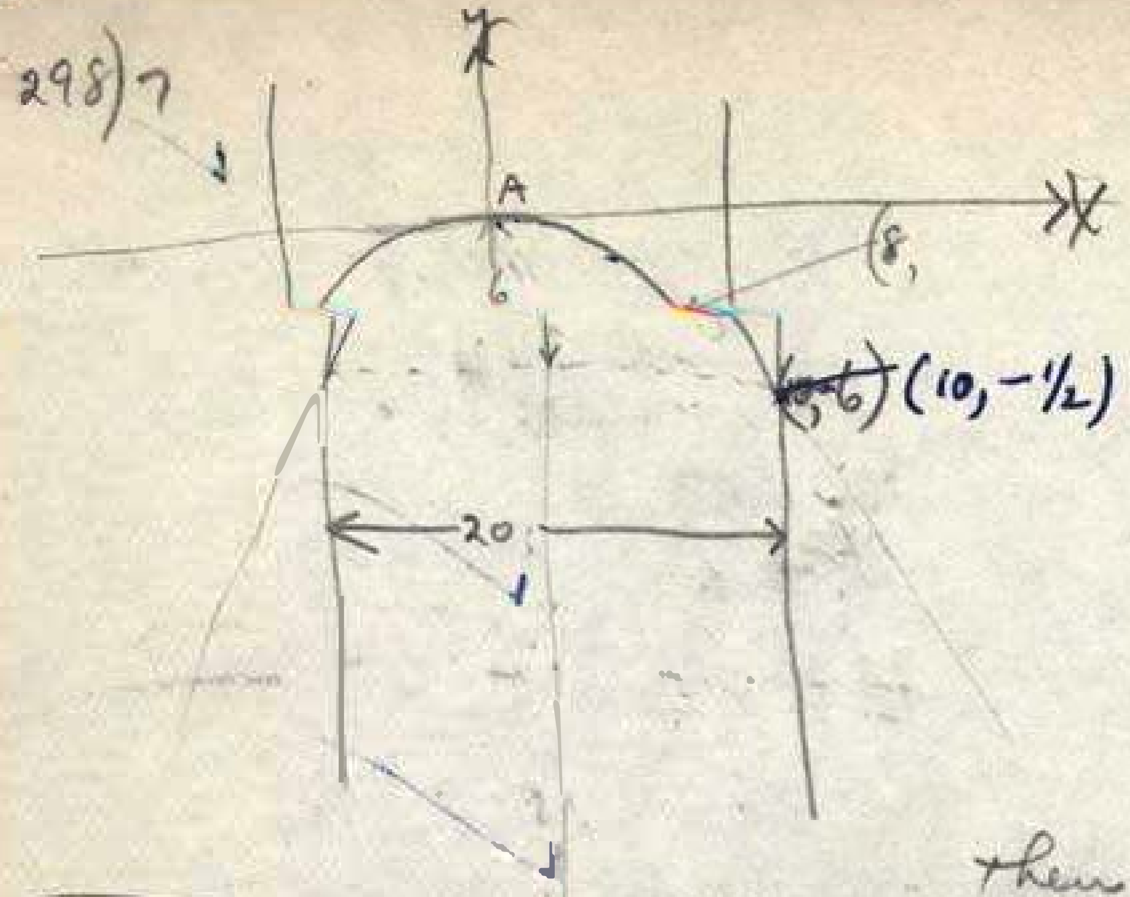
If base $= 10$, altitude $= 100$

Area $= b \times a = 10 \cdot 100 = 1000$

$\therefore \frac{1}{3}$ Area of ~~Rectangle~~

$= \dfrac{1000}{3} = 333\tfrac{1}{3}$ units

298) 7



Parabola is of type $x^2 = -2py$

If A is (0,0), ~~then it is given that~~ $y = \cancel{-6}\ -\frac{1}{2}$

when $x = 10$,

Then $100 = -2p\left(\cancel{-6}\ -\frac{1}{2}\right)$

$\frac{100}{-6} = -2p$ $\quad 100 = p$

$2p = 16\frac{1}{4}$

then $x^2 = -\cancel{\frac{50}{3}}\,200\,y$ $\quad x^2 = -200y$

When $x = 8$ (or -8), $\quad 64 = -\cancel{\frac{50}{3}}\,200\,y$

$x^2 = -\frac{50}{3}y$

Differentiating,

slope = m : $2x = -\frac{50}{3}\left(\frac{dy}{dx}\right)$

$m = \frac{dy}{dx} = \frac{2x}{-\frac{50}{3}} = 2x\left(-\frac{3}{50}\right) = -\frac{3}{25}x$

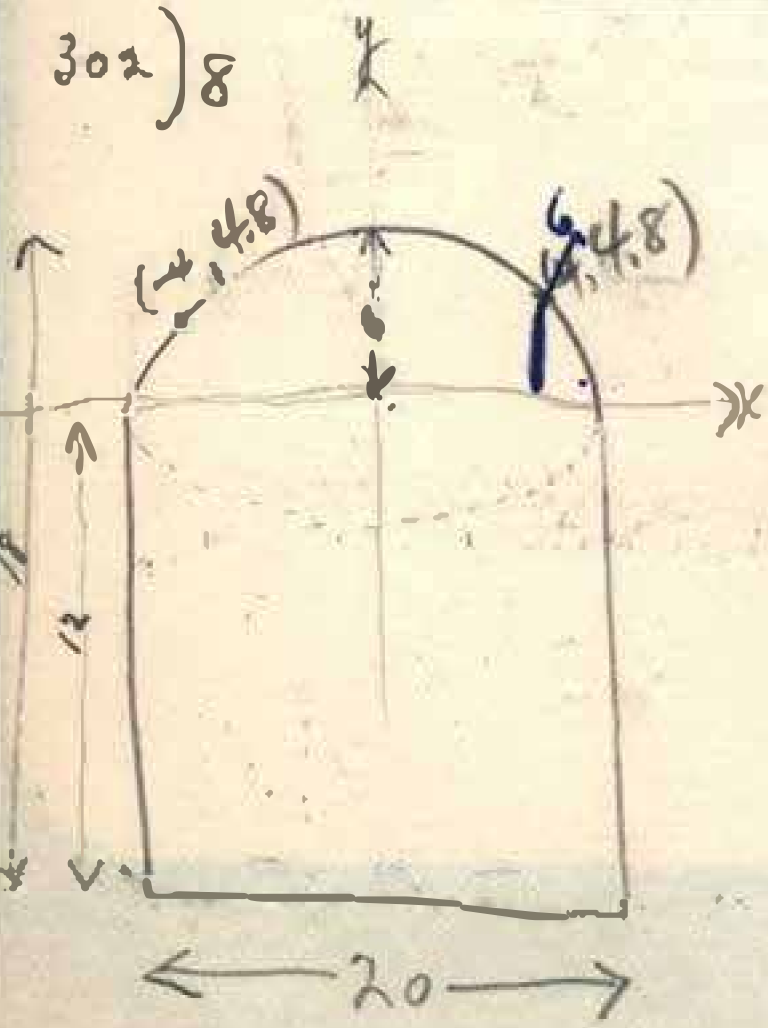
$= -\frac{3}{25}\cdot 10 = -6/5$

$y = 64\left(-\frac{3}{50}\right) = 32\left(-\frac{3}{25}\right)$

$y = -\frac{96}{25}$ ~~x~~

∴ drop 8 in. from middle $= 3\frac{21}{25}$ inches

302) 8



$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

$a = 10$

$b = 6$

Then $\frac{x^2}{100} + \frac{y^2}{36} = 1$ (Equation of Ellipse) ✓

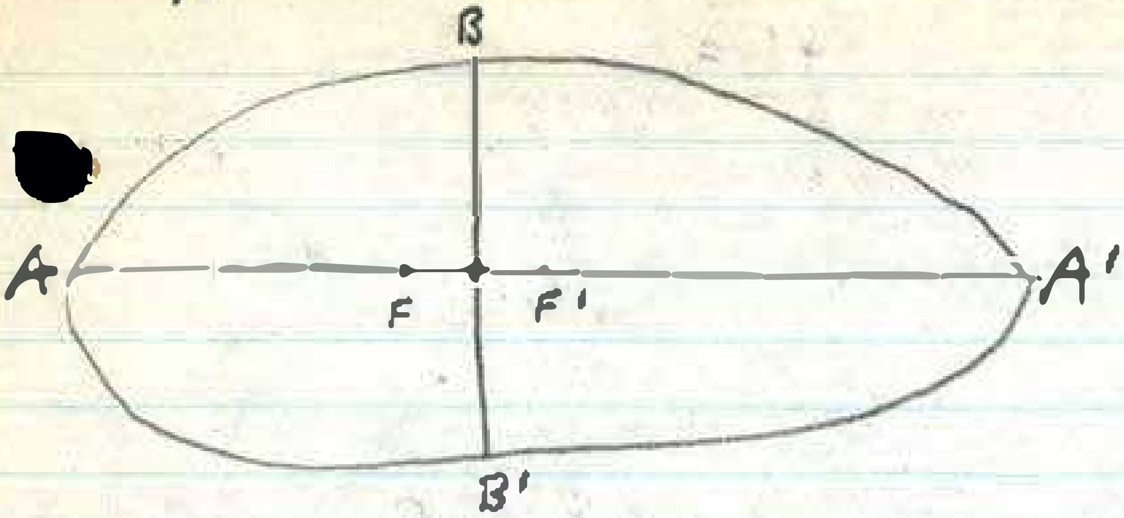
When $x = 6$ (or -6),

$\frac{36}{100} + \frac{y^2}{36} = 1$

$\frac{y^2}{36} = 1 - \frac{36}{100}$, $y^2 = \frac{64}{100}\cdot(36)$, $y = \pm 4.8$ ✓

∴ Height = 4.8 in (4 inches from either wall)

Griffin 30r) 14



$FF' = 3\,000\,000$ miles

$AA' = 186\,000\,000$ mile

To find BB'

$c = $ ~~1.5 million miles~~

$a = 93$ " "

$b^2 = a^2 - c^2$

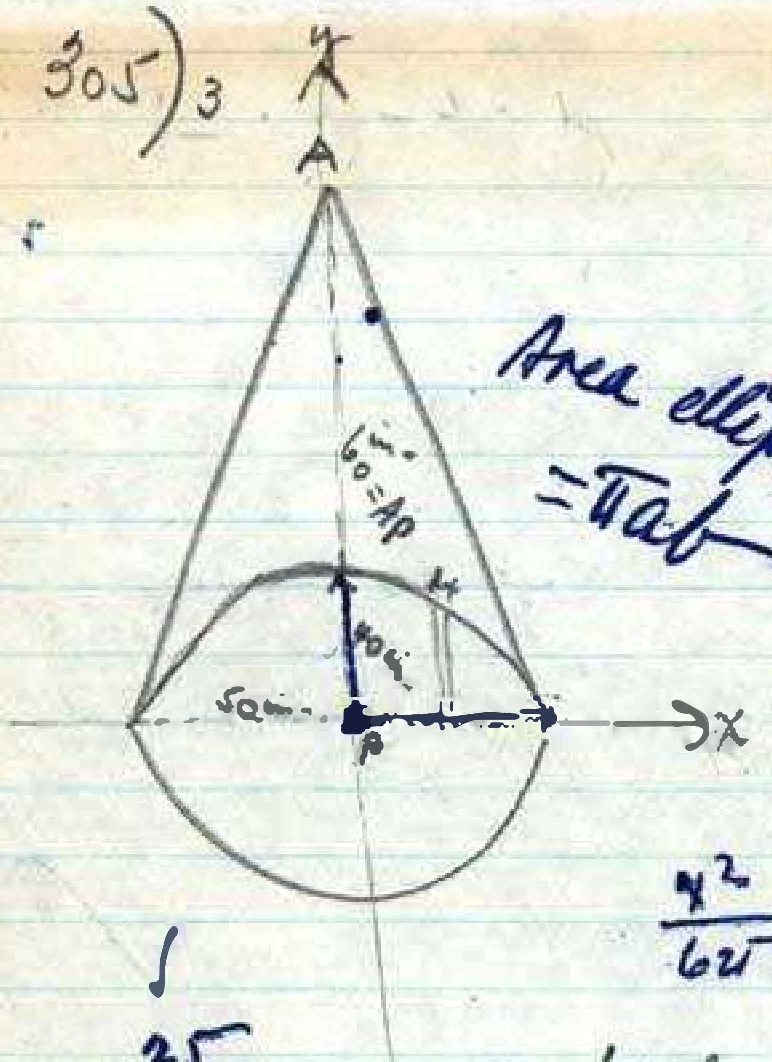
$b = \sqrt{a^2 - c^2} = \sqrt{8449 - 2.25}$

$b = 91.8$ million miles

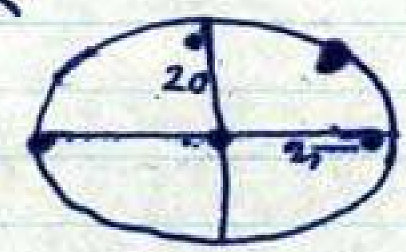
(shorter diameter) $2b = 183{,}600{,}000$ miles

---

305) 3



Area ellipse $= \pi ab$



Let P = center of Ellipse, represented by origin of coord. axes

$y = \frac{4}{5}x$

El. of area of ellipse (upper right quad.) $= y\,dx$

Total area of Ellipse $= 4\int_0^{50} \left(\frac{4}{5}x\right) dx$

$= 4 \cdot \frac{4}{5} \cdot \frac{x^2}{2}\Big]^{50}$

$= \frac{8x^2}{5}\Big]_0^{50} = 4000$ sq. in

$\frac{x^2}{625} + \frac{y^2}{400} = 1$

Volume of Cone $= \frac{1}{3}$ alt. (radius) $\times$ area of base

$A = \frac{16}{5}\int_0^{25} \sqrt{625 - x^2}\,dx$

$\frac{y^2}{400} = 1 - \frac{x^2}{625}$

$= \frac{1}{3} \cdot 60 \cdot \frac{16}{5} \cdot \frac{625\pi}{4}$

$= \frac{625 - x^2}{625}$

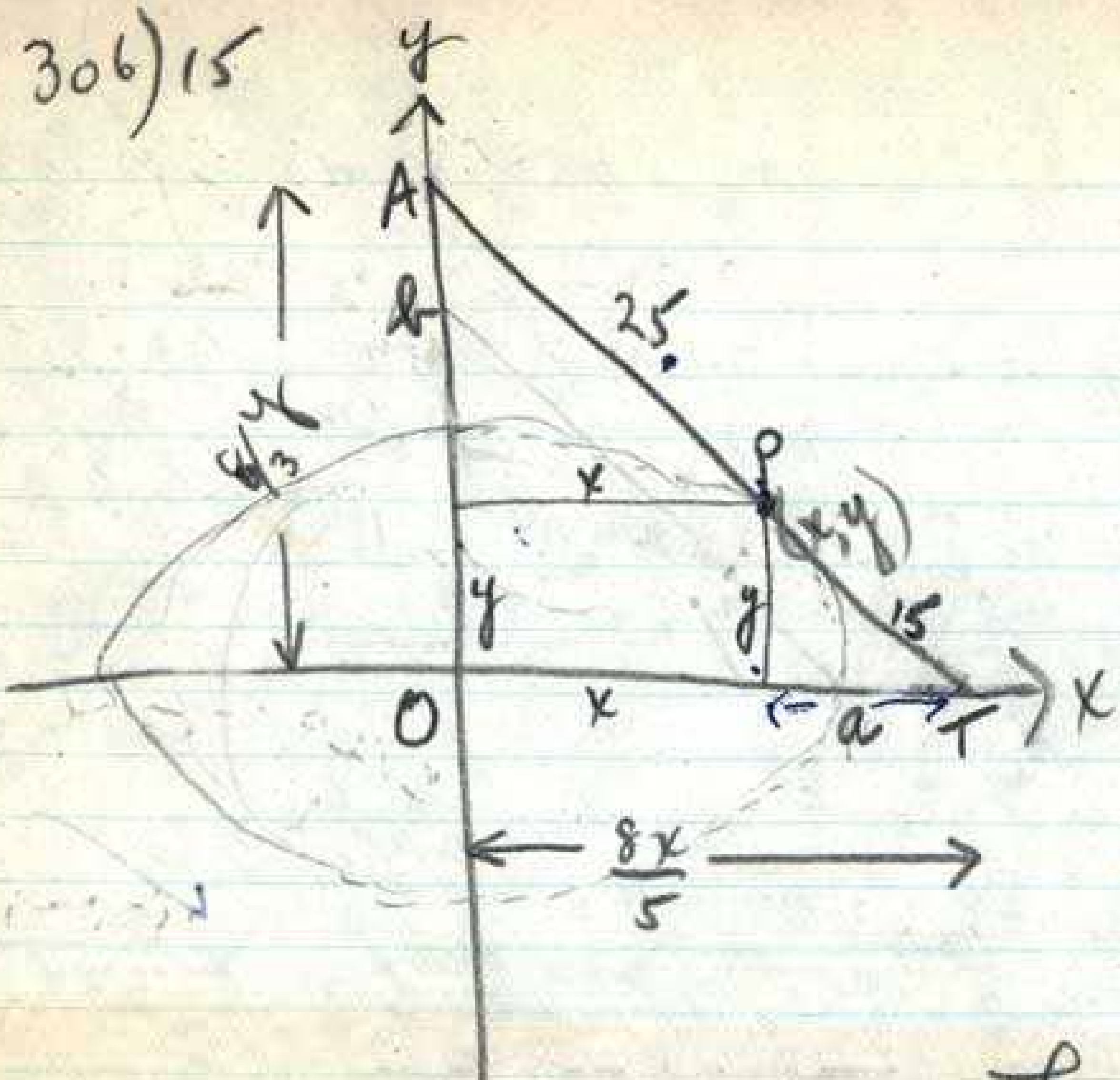
$= 80000$ cu. inches

~~$u = 625 - x^2$~~

~~$du = -2x\,dx$~~

$y^2 = \frac{16}{25}(625 - x^2)$, $y = \frac{4}{5}\sqrt{625 - x^2}$

306) 15



AT = 40 cms.
AP = 25 cms.
PT = 15 cms.

Let (x, y) = coordinates of given point

By similar triangles,

$$\frac{a}{15}=\frac{x}{25}$$

$$a=\frac{15x}{25}=\frac{3x}{5}$$

Then $OT = x+a = x+\frac{3x}{5}=\frac{8}{5}x$

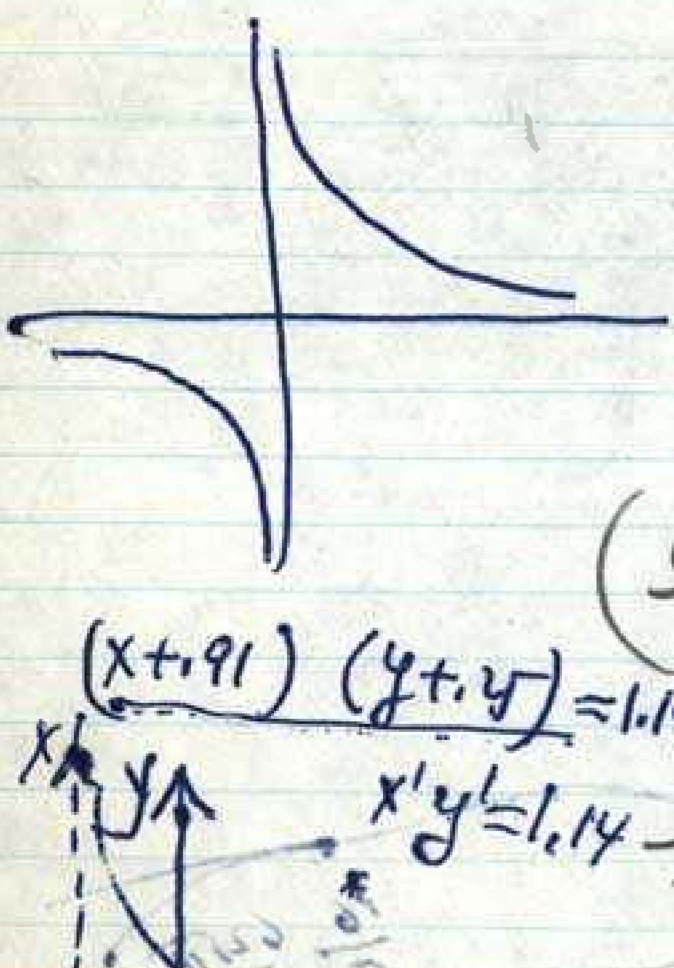
Also $\frac{b}{25}=\frac{y}{15}$

$$b=\frac{25y}{15}=\frac{5y}{3}$$

Then $OA = y+b = y+\frac{5y}{3}=\frac{8y}{3}$

$$\left(\frac{8x}{5}\right)^2+\left(\frac{8y}{3}\right)^2=(40)^2$$

$xy = C$



$(x+.91)\ (y+.y)=1.14$

$x'y'=1.14$

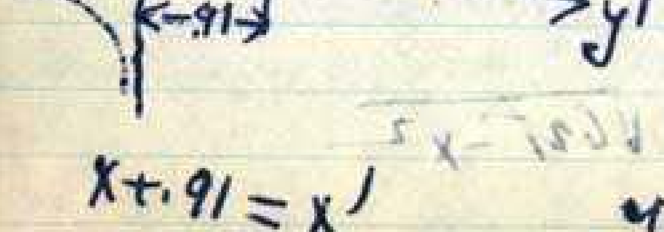
$$\frac{x^2}{25}+\frac{y^2}{9}=25$$

$$\frac{x^2}{625}+\frac{y^2}{225}=1$$

(Ellipse c center at origin)

a = 25

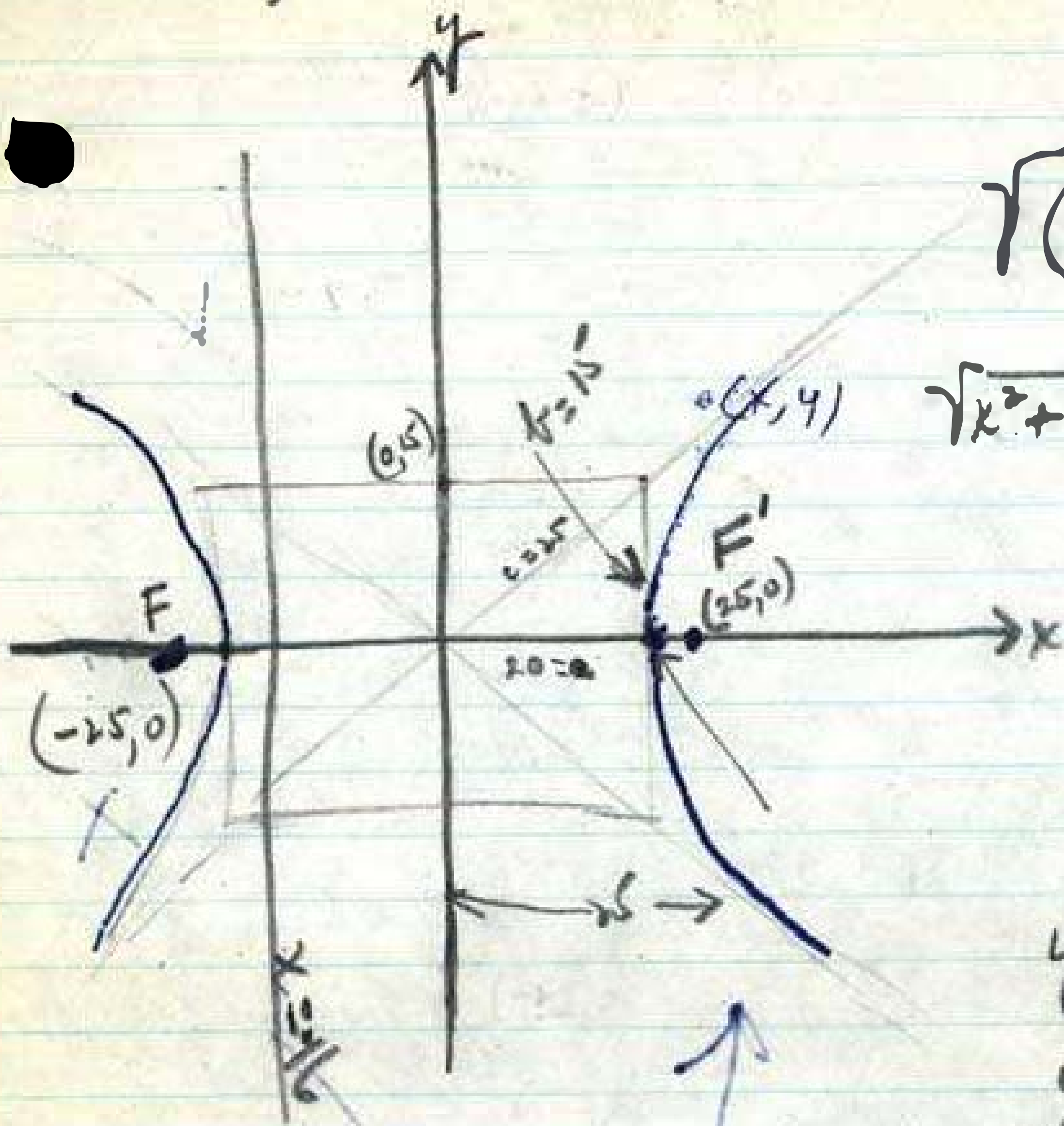
b = 15



$x+.91=x'$

$y+.25=y'$

Griffin 309) 11



Let (x, y) = coordinates of given point

$$\sqrt{(x+25)^2+(y-0)^2} = \frac{5}{4}\sqrt{(x+16)^2+(y-y)^2}$$

$$\sqrt{x^2+50x+625+y^2} = \frac{5}{4}\sqrt{x^2+32x+196}$$

$$x^2+50x+625+y^2 = \frac{25}{16}(x^2+32x+196)$$

$$x^2+50x+625+y^2 = \frac{25}{16}x^2+50x+400$$

$$y^2-\frac{9}{16}x^2+225 = 0$$

$$y^2-\frac{9}{16}x^2 = -225$$

$$\frac{y^2}{225}-\frac{x^2}{400} = -1$$

$$\frac{x^2}{400}-\frac{y^2}{225} = 1$$

(F, F') Foci on x-axis

$a = 20$ = real intercept

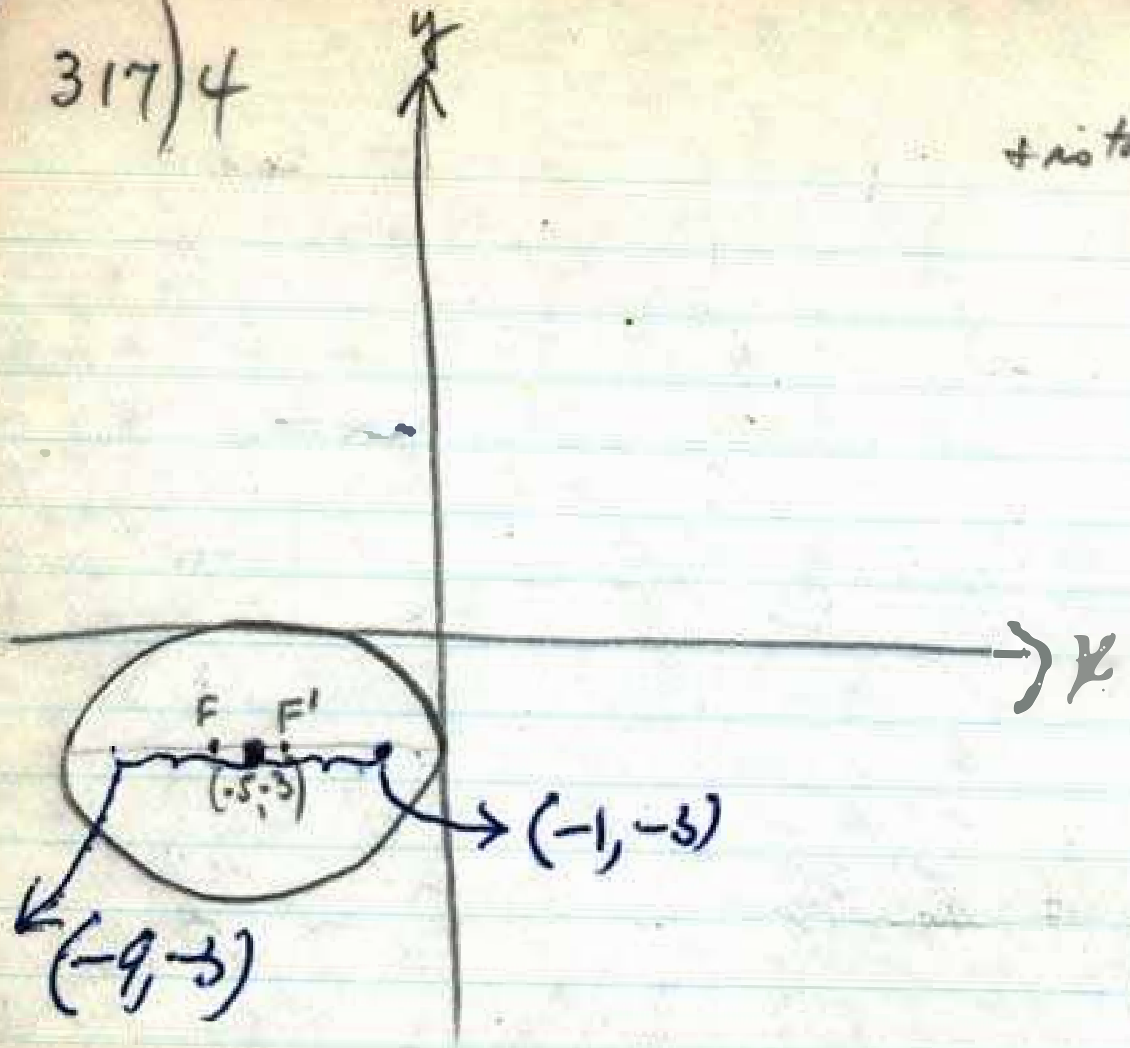
$b = 15$ = imaginary intercept

$c^2 = a^2+b^2 = 400+225 = 625$

$c = 25$

slope of Asymptote $= \pm\frac{b}{a} = \pm\frac{15}{20} = \pm\frac{3}{4}$

317) 4



Center of Ellipse at (-5, -3)
+ is tangent to x + y axes

Equation — $\frac{(x+5)^2}{25} + \frac{(y+3)^2}{9} = 1$ ✓

$a = 5$
$b = 3$

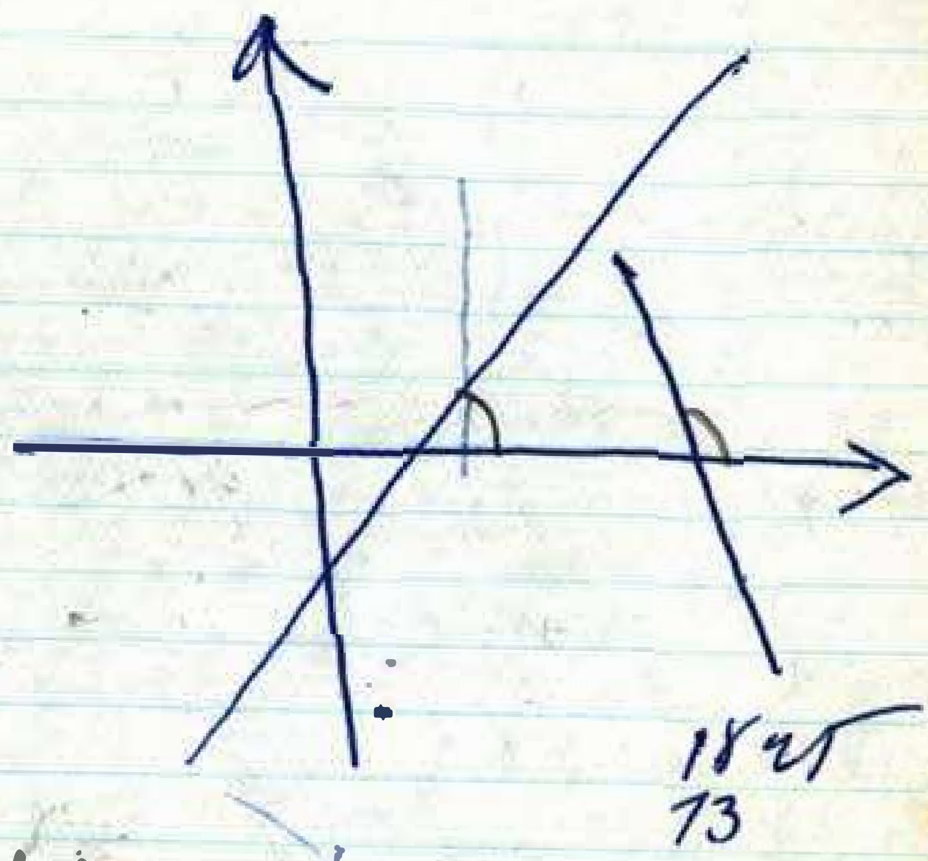
$\therefore c = \sqrt{25-9} = \sqrt{16} = 4$ ✓

$\therefore$ Foci are at $(-4,-3) + (-6,-3)$ ✗

---

318) 14

$$y = \frac{(.73 - .2x)}{(.73 + .8x)}$$



$.73y + .8xy = .73 - .2x$

$.73y + .8xy + .2x = .73$

multiplying by 5

$3.65y + 4xy + x = 3.65$

$4xy + x = 3.65 - 3.65y$

$x(4y+1) = 3.65(1-y)$

$\frac{4y+1}{1-y} = \frac{3.65}{x}$

1825
73

$.73 \times .81 = 73, 6.57\,3, 764$

$73 \times 25 = 365, 146, 1825$

$.25 \times .8 = .200$

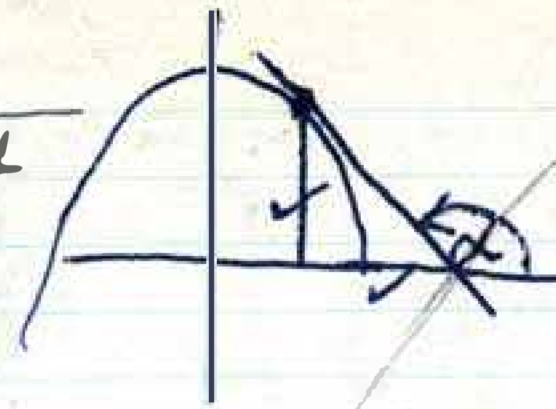
$$y + .25 = \frac{.73 - .2x}{.73 + .8x} + .25 = \frac{.73 - \cancel{.2x} + .1825 + \cancel{.2x}}{.73 + .8x}$$

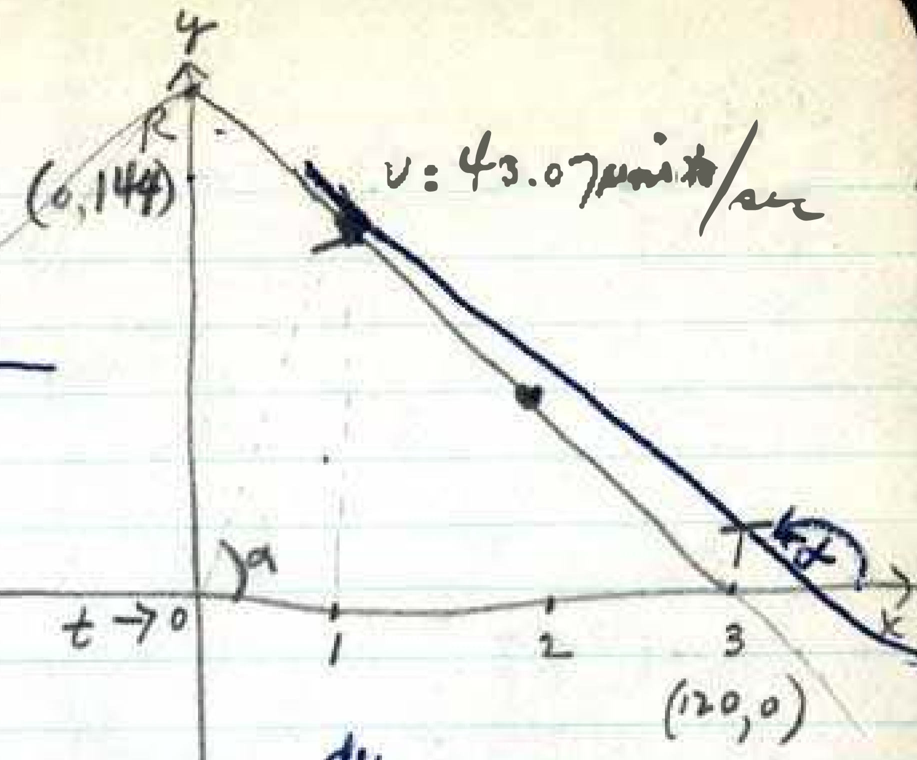
$$= \frac{.9125}{.73 + .8x}$$

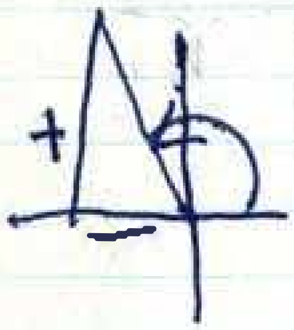
$\cancel{(4 + .9..)}\left(\frac{.9125}{.73 + .8x}\right) = 1.14$

Griffin 326) 17

t	x	y
0	0	144
1	40	128
2	80	80
3	120	0







$x = 40t$
$y = 144 - 6t^2$

$$\frac{dy}{dx} = \frac{-16t}{40} = -2/5$$

Velocity along x-axis $= 40$ ✓ (v_x)

Velocity along y-axis $= -16t$ ✓

$$v = \sqrt{v_x^2 + v_y^2} = \sqrt{(40)^2 + (-16t)^2}$$

at $t=1$, $v = \sqrt{1600 + 256} = \sqrt{1856} = 43.07$ units/sec.

going obliquely downward

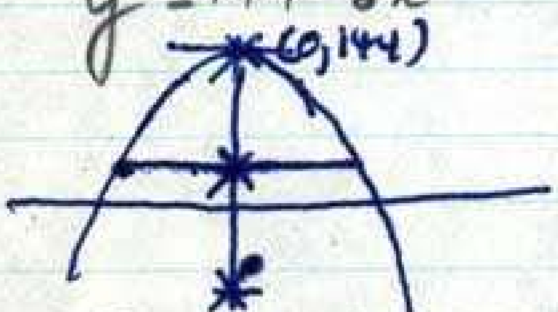
$\tan\alpha = \frac{16}{40} = 2/5$ (How about − sign? $\tan\alpha = \frac{v_y}{v_x}$.)

---

326) 18 To prove path of above was a parabola.

$x = 40t$
$y = 144 - 6t^2$

$$\left.\begin{aligned} x^2 &= 1600t^2 \\ y &= 144 - 6t^2 \end{aligned}\right\} \quad \begin{aligned} 3x^2 &= 4800t^2 \\ 800y &= -4800t^2 + 115200 \end{aligned}$$



① → adding, $3x^2 + 800y = 115200$ ✓

$800y = -3x^2 + 115200$

or $3x^2 = -800y + 115200$ ✓

Equation is that of parabola c̄ limbs going downward

differentiating, $6x + 800\frac{dy}{dx} = 0$, $\frac{dy}{dx} = \frac{-6x}{800} = -\frac{3x}{400}$

∴ vertex is at $(0,144)$, + the axis is $x = 0$. ✓

Setting derivative at 0, $\frac{-3x}{400} = 0$,

Since $3x^2 = -800y + 115200$

$x^2 = -\frac{800}{3}y + 38400 = -\frac{800}{3}(y - 144)$

$x = 0$

Substituting in ①, $800y = 115200$

$4p = \frac{800}{3}$, $p = \frac{200}{3}$ $\left(144 - \frac{200}{3} = 23\frac{2}{3}\right)$

$y = 144$

∴ Focus is at $(0, 23\frac{2}{3})$. Latus Rectum $= \frac{800}{3}$

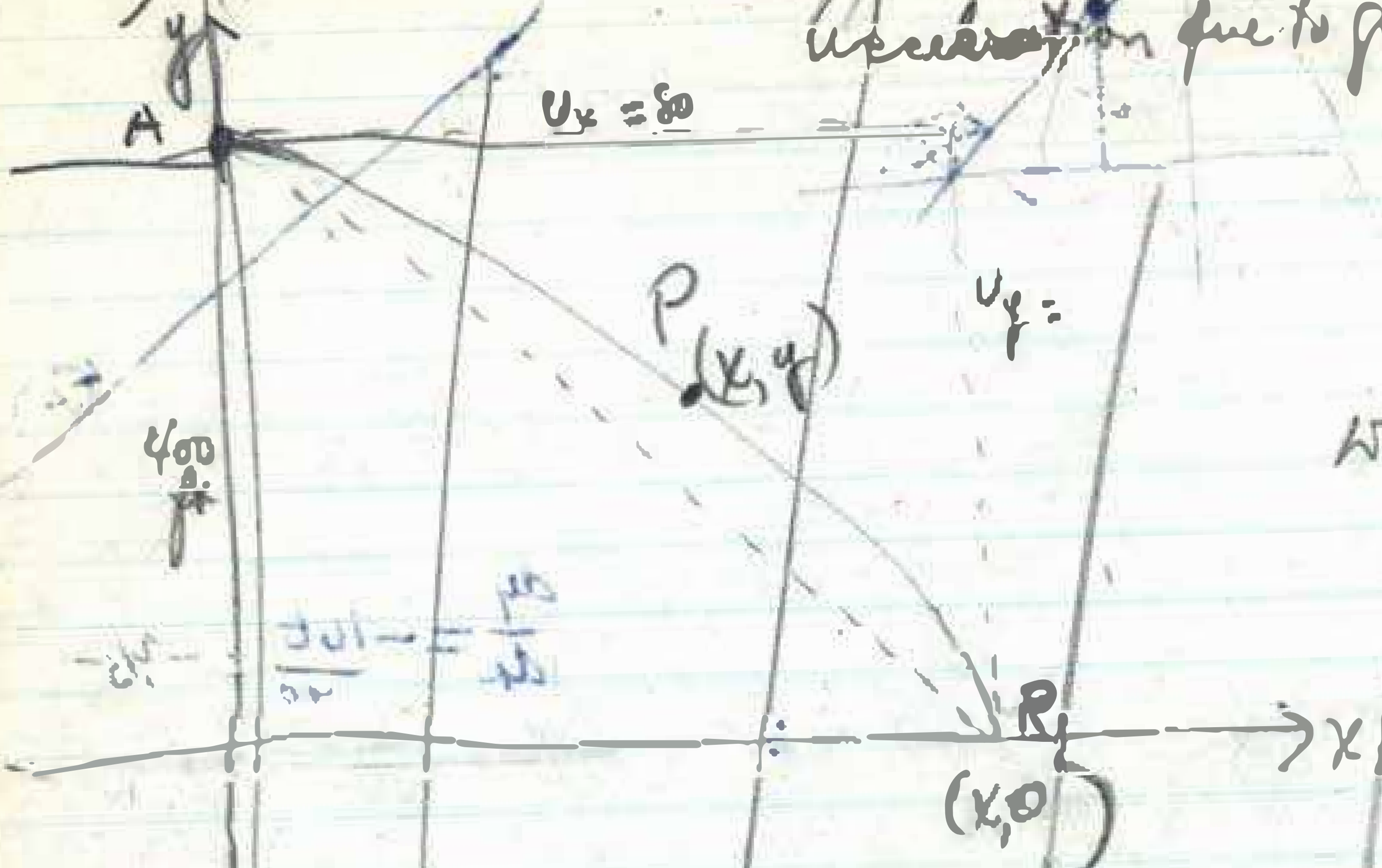
326) 19

$v = 80$ ft./sec. horizontal

Acceleration due to gravity $= -32$ ft/sec^2

$$v = \int a\,dt = \int -32\,dt$$
$$= -32t + C$$

When $t=0$, $x=0$, $y=400$, $+\,v=0$ (downward), $\therefore C = 0$



Let (x, y) represent coordinates of point on locus of path of ball

Then $(\overline{AP} + \overline{PR})$ must be a constant (p)

$$\sqrt{(x-0)^2+(y-400)^2} + \sqrt{(x-x)^2+(y-0)^2} = p$$

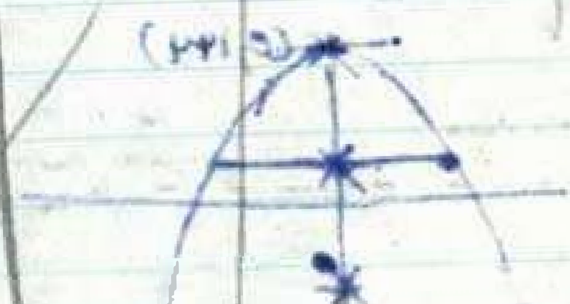
$$\sqrt{x^2+y^2-800y+160000} + \sqrt{y^2} = p$$

$$\sqrt{x^2+y^2-800y+160000} = p - y$$

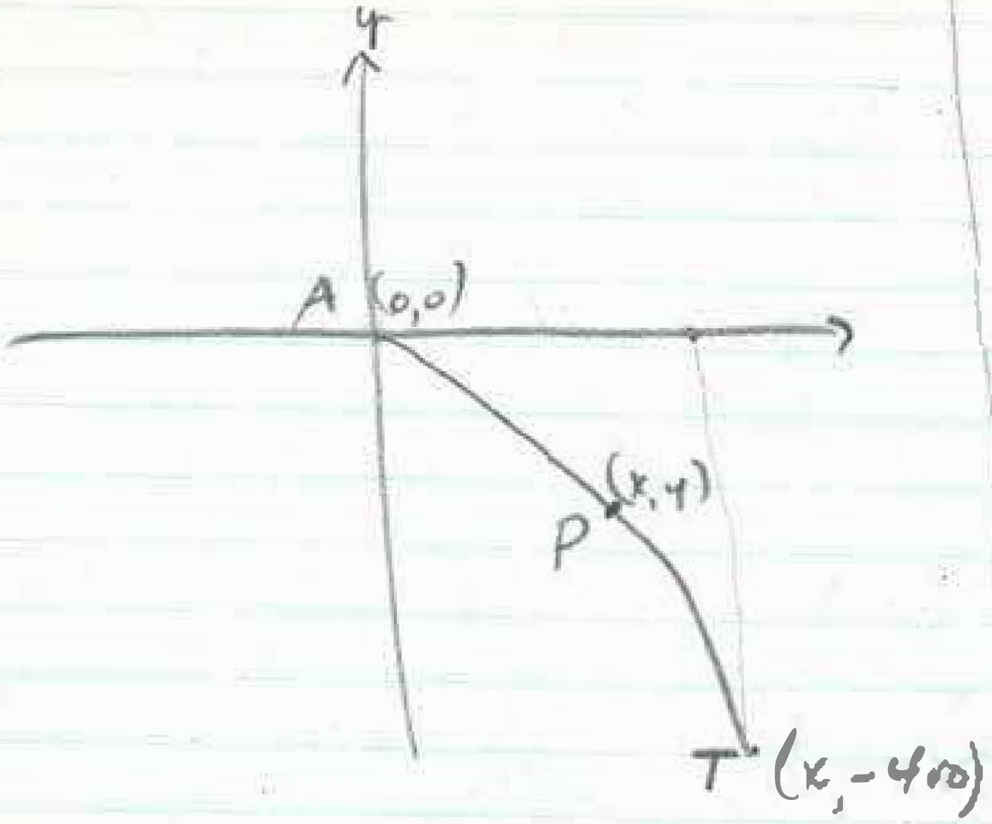
Squaring $x^2+y^2-800y+160000 = p^2-2py+y^2$

$$x^2 - 800y - p^2 + 2py = 0$$

This is equation of parabola c̄ limbs extending downwards.



Griffin 3r6)1a



$$AP + PT = AT$$

$$\sqrt{x^2+y^2} + \sqrt{(y+400)^2} = \sqrt{x^2+(-400)^2}$$

$$\sqrt{x^2+y^2} + y + 400 = \sqrt{x^2+160000}$$

Squaring

$$x^2+y^2 + 2(y+400)\sqrt{x^2+y^2} = x^2+160000$$

$$\sqrt{x^2+y^2} = \frac{160000-y^2}{2y+800}$$

$$x^2+y^2 = \frac{25600000000-320000y^2+y^4}{4y^2+3200y+640000}$$

$$(x^2+y^2)(4y^2+3200y+640000) =$$

$$25600000000-320000y^2+y^4$$

Griffin 425)4

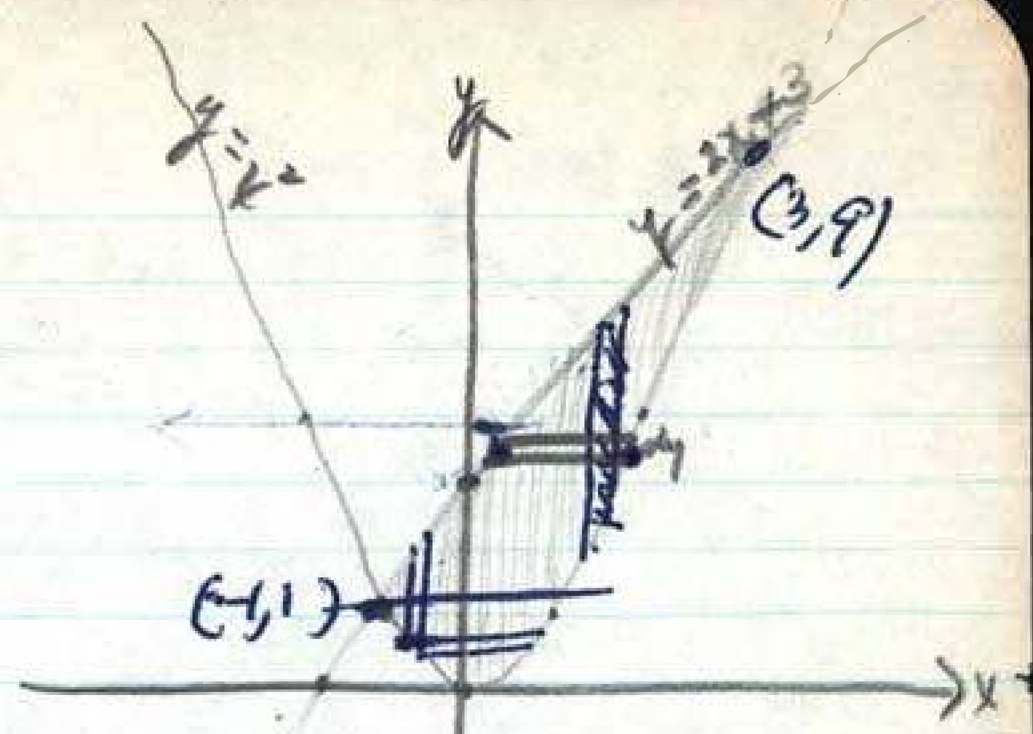
$y = x^2$

y	x
0	0
1	± 1
4	± 2
9	± 3

$y = 2x + 3$

when $x = 0,\ y = 3$

$y = 0,\ x = -3/2$



$y = x^2$

$x = \pm\sqrt{y}$

$y = 2x + 3$

$x = \dfrac{y-3}{2}$

$y = x^2$

$y = 2x + 3$

$x^2 - 2x - 3 = 0$

$(x-3)(x+1) = 0$

$x = 3,\ -1$

Intersection of line & curve at $(-1,1)$ & $(3,9)$

Element of Area $= (x_2 - x_1)\,dy$

Total Area $= \displaystyle\int_0^9 \left(\sqrt{y} - \frac{y-3}{2}\right) dy$

$= \displaystyle\int_0^9 y^{1/2}\,dy - \frac{1}{2}\int_0^9 (y-3)\,dy$

$= \left[\dfrac{2}{3} y^{3/2} - \dfrac{1}{2}\left(\dfrac{y^2}{2} - 3y\right)\right]_0^9$

$= \left[\dfrac{2}{3} y^{3/2} - \dfrac{1}{4} y^2 + \dfrac{3}{2} y\right]_0^9$

$= \left(\dfrac{2}{3}\cdot 27\right) - \dfrac{1}{4}(81) + \dfrac{3}{2}(9)$

$= 18 - \dfrac{81}{4} + \dfrac{27}{2}$

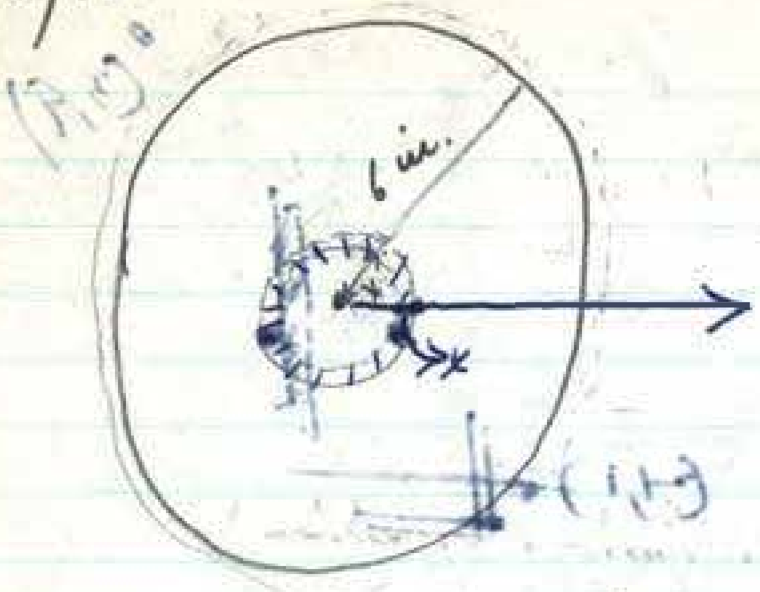
$= \dfrac{72 - 81 + 54}{4}$

$= \dfrac{45}{4}$ units

(Element Area $= (y_2 - y_1)\,dx$

Total Area $= \displaystyle\int_{-1}^{3} (2x + 3 - x^2)\,dx$

426/10



Area of Circle = πr^2

Element of Weight = $\pi x^2 w$

$= \pi x^2 (.2 - .03x)$

Total Weight = $\int_0^6 \left[\cancel{\pi x^2}(.2 - .03x)\right] dx$

$2\pi x$

$= \pi \int_0^6 \left(\frac{2}{10}x^2 - \frac{3}{100}x^3\right) dx$

$= \frac{\pi}{5}\int_0^6 x^2 dx - \frac{3\pi}{100}\int_0^6 x^3 dx$

$= \left.\frac{\pi x^3}{15} - \frac{3\pi x^4}{400}\right]_0^6$

$= \frac{216\pi}{15} - \frac{3888\pi}{400}$

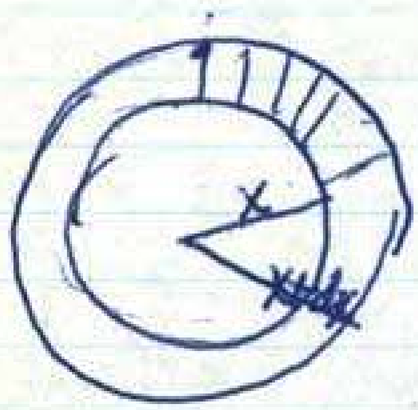
$= \frac{72\pi}{5} - \frac{486\pi}{50}$

$= \frac{72\pi}{5} - \frac{243\pi}{25}$

$= \frac{360\pi - 243\pi}{25}$

$= \frac{117\pi}{25}$ units

$dW = \underline{2\pi x\, dx}\,(.2 - .03x)$



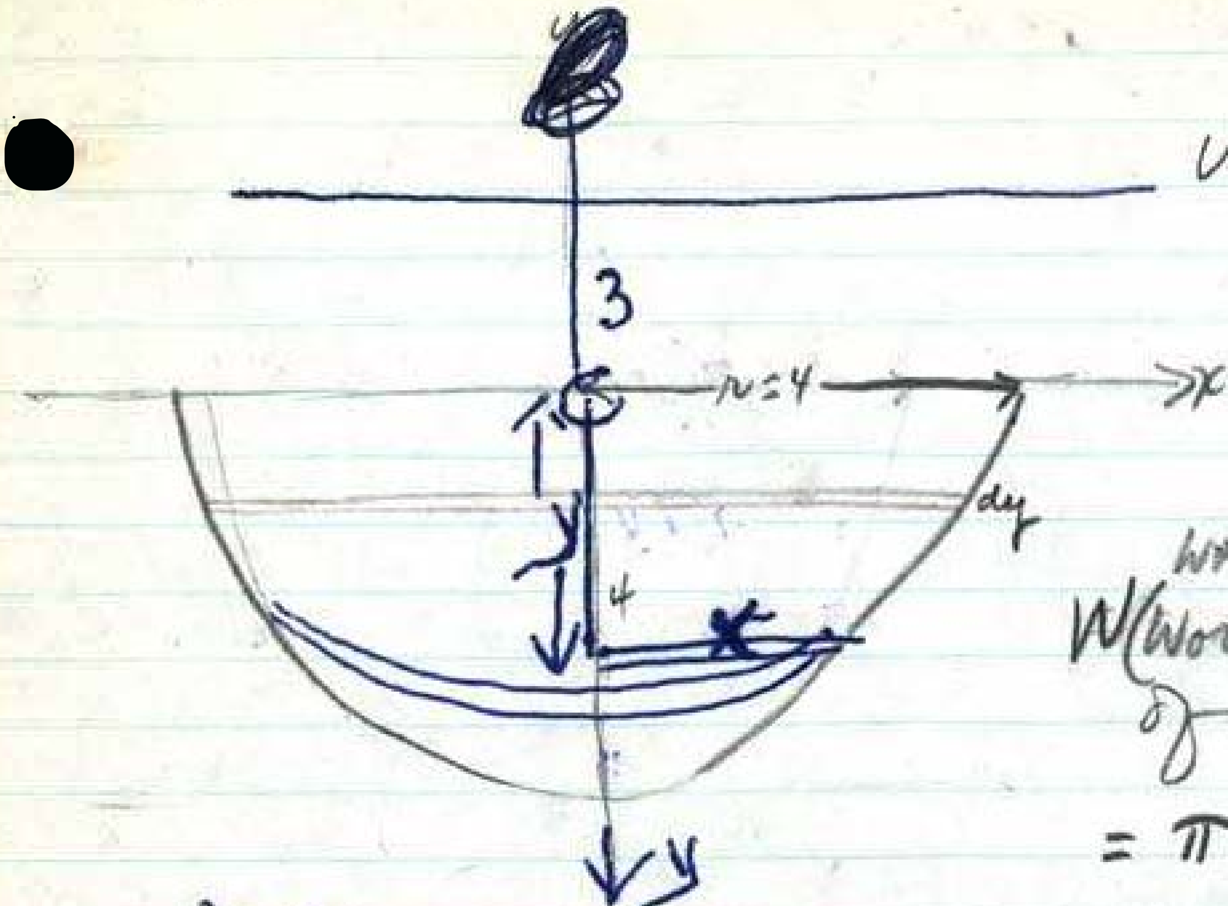
$\pi(x+dx)^2 - \pi x^2$

$\cancel{\pi x^2} + 2\pi x\, dx + \cancel{\pi dx^2} - \cancel{\pi x^2}$

$\underline{2\pi x\, dx}$

$W = 2\pi \int_0^6 x(.2 - .03x)\, dx$

Griffin 426) 13



Volume of sphere $= \frac{4}{3}\pi r^3$

Volume of Hemi-spherical cylinder

$= \frac{1}{2} \cdot \frac{4}{3}\pi r^3$

$= \frac{2}{3}\pi r^3$

Wt. of water $(w) = 62.5$ lb/ft.^{3}

W (Work required) to lift element of volume of water (of dy depth)

$= \pi r^2 w \cdot dy$

$x^2+y^2=16$ Total Work to raise to level 3 ft. above $(3+y)\,\pi x^2\,dy\,(62.5)$

$x^2=16-y^2$ the top $= \int_0^3 \pi r^2 \cdot w \cdot y\, dy$

$Wk = 62.5\pi \int_0^3 x^2(3+y)\,dy$

$= 16\pi w \int_0^3 y\,dy = \frac{16\pi w y^2}{2}\Big]_0^3$

$= 62.5\pi \int_0^3 (16-y^2)(3+y)\,dy$

$= 8\pi w y^2\Big]_0^3$

$\int_a^b [f(x)dx + \cancel{g(x)dx^2} + \cancel{h(x)dx^3}]dx$

$= 8\pi(\cancel{62.5})\cdot(9)$

$= \cancel{4500\pi}$ ft. lbs.

$$\frac{(2n-2)!}{2n!} = \frac{\cancel{1.2.3 \cdots (2n-2)}}{\cancel{1.2.3 \cdots (2n-2)}(2n-1)2n}$$

M + B

438) 4

$$1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \cdots + \frac{x^{(2n-2)}}{(2n-2)!} - \frac{x^{(2n)}}{(2n)!} + \cdots$$

$$\lim_{n \to \infty} \left(\frac{a_{n+1}}{a_n}\right) = -\lim_{n \to \infty} \left(\frac{\cancel{x^{2n}}\ x^2}{\cancel{(2n)!}} \cdot \frac{\cancel{(2n-2)!}\ 2n-2}{x^{(2n-2)}} \right)$$

$$= -\lim_{n \to \infty} \left(x^2 \frac{\cancel{(2n-2)}}{(2n-1)(2n)} \right) = -\cancel{2x^2}\ 0$$

~~series converges $-2x^2 < 1$ or $|x^2| < -\frac{1}{2}$~~

~~diverges $-2x^2 > 1$ $|x^2| > -\frac{1}{2}$~~

If $x^2 = -\frac{1}{2}$ (no real number)

All real values of x are within interval of convergence

series conv. for every value of x.

---

438) 5

$$1 + 1!(x) + 2!\,x^2 + 3!\,x^3 + \cdots + (n-1)!\,x^{(n-1)} + n!\,x^n + \cdots$$

$$\lim_{n \to \infty} \left(\frac{a_{n+1}}{a_n}\right) = \lim_{n \to \infty} \frac{n!\,x^n}{(n-1)!\,x^{n-1}} = \lim_{n \to \infty} \frac{nx}{\cancel{n-1}} = \cancel{0}\ \infty$$

$$\cancel{\frac{1 \cdot 2 \cdot 3 \cdots (n-1)\,n}{1 \cdot 2 \cdot 3 \cdots (n-1)}}$$

$n-1$

[redacted]

∴ series converges only when $x = 0$

series diverges for every x, except $= 0$

---

439) 9

$$1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots + \frac{x^{n-1}}{(n-1)!} + \frac{x^n}{n!} + \cdots$$

$$\lim_{n \to \infty} \frac{x^n}{\cancel{n!}\ n} \cdot \frac{\cancel{(n-1)!}}{x^{n-1}} = \lim_{n \to \infty} \left(\frac{x}{n}\right) \cancel{(n-1)} = \cancel{x}$$

$= 0$

∴ Series conv. for every x

439) 14

$$\frac{(x-2)}{1!} - \frac{(x-2)^3}{3!} + \frac{(x-2)^5}{5!} - \frac{(x-2)^7}{7!} + \dots + \frac{(x-2)^{2n-1}}{(2n-1)!} - \frac{(x-2)^{2n+1}}{\cancel{(2n)!}\ (2n+1)!} + \dots$$

$$\lim_{n\to\infty} \frac{\cancel{(x-2)}^{2n}}{2n!} \cdot \frac{(2n-1)!}{\cancel{(x-2)}^{2n-1}} = \lim_{n\to\infty}\left[\frac{(x-2)}{2n}\right] = \frac{x-2}{2}$$

converges when $\frac{x-2}{2} < 1$, $x-2 < 2$, $x < 4$

diverges when $\frac{x-2}{2} > 1$, $x-2 > 2$, $x > 4$

When $x = 4$,

$$\frac{2}{1!} - \frac{2^3}{3!} + \frac{2^5}{5!} - \frac{2^7}{7!} + \dots \frac{2^{2n-1}}{(2n-1)!}$$

$$\frac{\cancel{\frac{(x-2)^{2n+1}}{(2n+1)!}}\ (x-2)^2}{\cancel{\frac{(2n-1)!}{(x-2)^{2n-1}}}} \qquad \cancel{1.2.3.\dots(2n-1)}$$

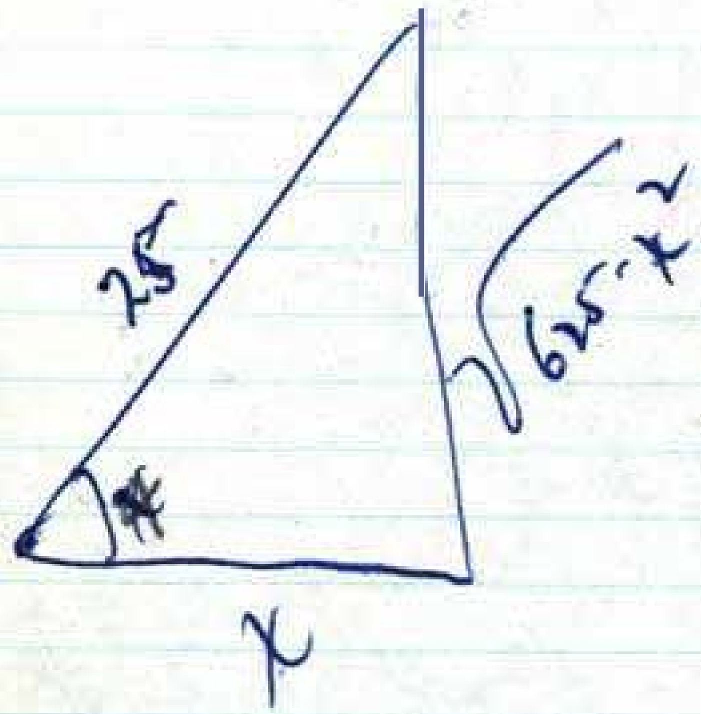
$\cancel{1.2.3 \dots (2n+1)}\ 2n(2n+1)$

$$\lim_{n\to\infty}\left[\frac{(x-2)^2}{2n(2n+1)}\right] = 0$$

series conv. for every value of $x-2$

for every value of x

$$\int \sqrt{625 - x^2}\,dx = \int 25 \sin\alpha \left(-25 \sin\alpha \, d\alpha\right)$$



$\cos\alpha = \dfrac{x}{25}$

$x = 25 \cos\alpha$

$dx = -25 \sin\alpha \, d\alpha$

$$= -625 \int \sin^2\alpha \, d\alpha$$

$$= -625 \int_{\pi/2}^{0} \frac{1 - \cos 2\alpha}{2} \, d\alpha$$

$$= \frac{-625}{2} \left[\alpha - \sin 2\alpha \left(\frac{1}{2}\right)\right]$$

$-\dfrac{625}{2}\left[\alpha - \dfrac{1}{2}\sin 2\alpha\right]$

$-\dfrac{625}{2}\left[\alpha - \sin\alpha\cos\alpha\right]$

$= -\dfrac{625}{2}\left[\cos^{-1}\dfrac{x}{25} - \dfrac{x\sqrt{625 - x^2}}{625}\right]$

$$-\frac{625}{2}\left[\alpha - \frac{1}{2}\sin 2\alpha\right]_{\pi/2}^{0}$$

$$-\frac{625}{2}\left[0 - 0\right] + \frac{625}{2}\left(\frac{\pi}{2} - \frac{1}{2}\sin\pi\right.$$

$\frac{\pi}{2} \times \frac{625}{2} = \frac{625\pi}{4}$

Griffin — 429 — 1c, e, 2a, 3e, 9

Longley, S + W — 425 — 2, 7

426 — 18, 21

429 — 1a, b

M + B 444, 1a, e, d

$x^2 = 25$

$y^2 = 25$

72
1250
4375
45000

$y = x^2$

at what rate does y change when $x = 5$?

16
16
96
16

~~$x = 5 \to y = 25$~~

$$\frac{dy}{dt} = 2x \frac{dx}{dt}$$

16
16
36
16

JANUARY						
S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

(1)

19 52

SUNDAY 27 JANUARY

27th Day

3rd Sunday after Epiphany

339 Days to come

Griffin 86/1, 13 93/11 99/9 102/6

111/11 117/5 126/10

132/4 133/9 150/7

165/4a 170/7, 8

212/1a 225/6

228/15 237/7

266/7

FEBRUARY						
S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	

TUESDAY 19 **29** 52 JANUARY

29th Day (2) Wm. McKinley—Born 1843 337 Days to come

Griffin ~~240/7~~ 289/7 290/16

295/7 296/16 298/7

302/8 302/14

305/3 306/15

309/11 317/4 318/14

326/17, 18, 19

425/4 426/10, 13

FEBRUARY						
S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	

WEDNESDAY 19 **30** 52 JANUARY

30th Day

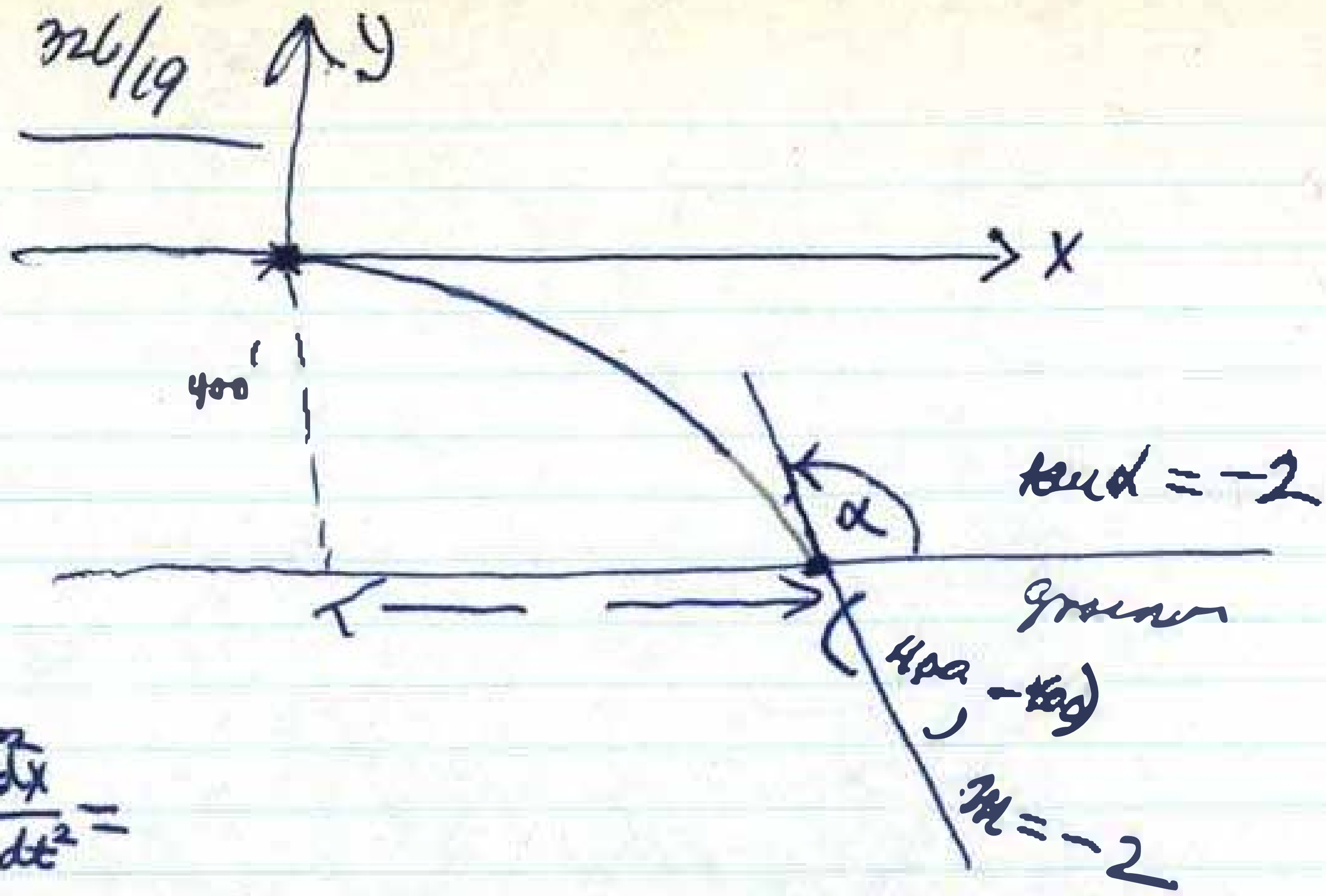
Franklin Delano Roosevelt—Born 1882

336 Days to come

JANUARY

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Diff. 3/26/69



$\frac{d^2x}{dt^2} =$

$dy/dt =$

$\underline{F = ma}$

Vel. in x-dir. $= dx/dt$

acc. x-dir. $= d^2x/dt^2$

$$\begin{cases} \frac{d}{dt} V_x = 0, & V_x = C \\ \frac{d}{dt} V_y = -32, & V_y = -32t + K \end{cases}$$

$t=0, V_x = 80$

$t=0, V_y = 0$ $y=0$

$$\left.\begin{matrix} V_x = 80 \\ V_y = -32t \end{matrix}\right\} \quad \frac{dx}{dt} = 80$$

$$\frac{dy}{dt} = -32t$$

$V_x = 80$

$V_y = -160$

$\underline{V = \sqrt{80^2 + 160^2}}$

$$\begin{cases} X = 80t + C' \\ y = -16t^2 + C'' \end{cases}$$

$t=0, x=0, y=0$

$C' = 0$

$C'' = 0$

$$\frac{dy}{dx} = -\frac{2x}{400} = -2$$

$$\left\{\begin{matrix} x = 80t \\ y = -16t^2 \end{matrix}\right\}$$

$t = x/80$

$$y = \frac{-16x^2}{6400} = \frac{-x^2}{400}$$

$$\frac{x^2}{400} = 400$$

$x^2 = 400^2$

$f(x) = \sin x \qquad f(0) = 0$

$f'(x) = \cos x \qquad f'(0) = 1$

$f''(x) = -\sin x \qquad f''(0) = 0$

$f'''(x) = -\cos x \qquad f'''(0) = -1$

$f^{iv}(x) = \sin x \qquad f^{iv}(0) = 0$

$f^{v}(x) = \cos x \qquad f^{v}(0) = 1$

$$\sin x = x - \frac{1}{3!}x^3 + \frac{1}{5!}x^5 - \cdots$$

$\sin 1^\circ$

$x = .01745$

$$\sin 1^\circ = \boxed{.01745} - \frac{1}{6}(.01745)^3 + \frac{1}{120}(.01745)^5 - \cdots$$

$.01745$

$.00001$

$$\sin 5^\circ = .08727 - \frac{1}{6}(.08727)^3 + \frac{1}{120}\cancel{(.08727)^5} - \cdots$$

$x = .08727$