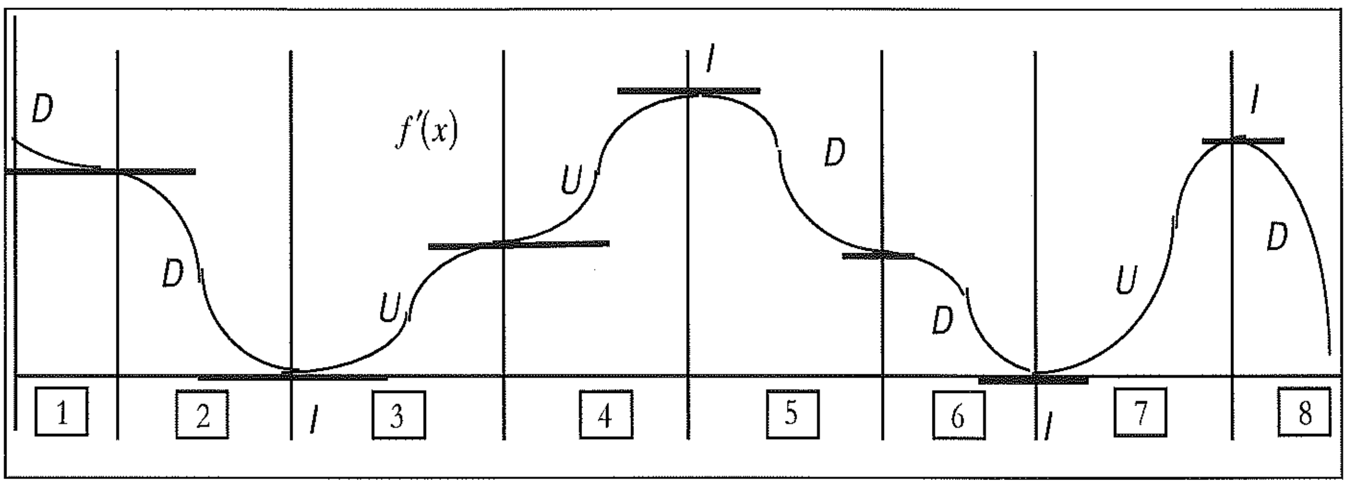
AB Clue Problem Set # 20 Solutions

Suspect Problem: Find $f'(-2)$ if $f(x)=(x+2)(x+3)(x+4)^2$

$$\boxed{\begin{aligned} &f(x)=\left(x^2+5x+6\right)\left(x^2+8x+16\right)\\ &f'(x)=\left(x^2+5x+6\right)(2x+8)+\left(x^2+8x+16\right)(2x+5)\\ &f'(-2)=0(4)+4(1)=4 \end{aligned}}$$

The answer is 4.

Location Problem: Below is a graph of $f'(x)$ (locations where the graph has horizontal tangents are indicated in bold). The graph has been divided into 8 partitions. If U represents the number of partitions $f(x)$ is concave up, D represents the number of partitions $f(x)$ is concave down, and I represents the number of inflection points of $f(x)$, find the value of $I+D-U$.



$$\boxed{D=5,\ U=3,\ I=4 \qquad\qquad I+D-U=6}$$

The answer is 6.

Treasure Problem: Find the volume if the graph of $y=\sqrt{\frac{20}{\pi}}\,e^{\frac{x}{2}}$ is rotated about the x-axis from $x=\ln\left(\frac{1}{2}\right)$ to $x=0$.

$$\boxed{\begin{aligned} &V=\pi\int_{\ln(1/2)}^{0}\left(\sqrt{\frac{20}{\pi}}\,e^{\frac{x}{2}}\right)^2 dx=\pi\int_{\ln(1/2)}^{0}\frac{20}{\pi}e^x\,dx\\ &\left[20e^x\right]_{\ln(1/2)}^{0}=20-20e^{\ln(1/2)}=20-20\left(\frac{1}{2}\right)=10 \end{aligned}}$$

The answer is 10.

AB Clue Problem Set # 20

Suspect Problem: Find $f'(-2)$ if $f(x)=(x+2)(x+3)(x+4)^2$

$f(x) = (x^2+5x+6)(x+4)^2$

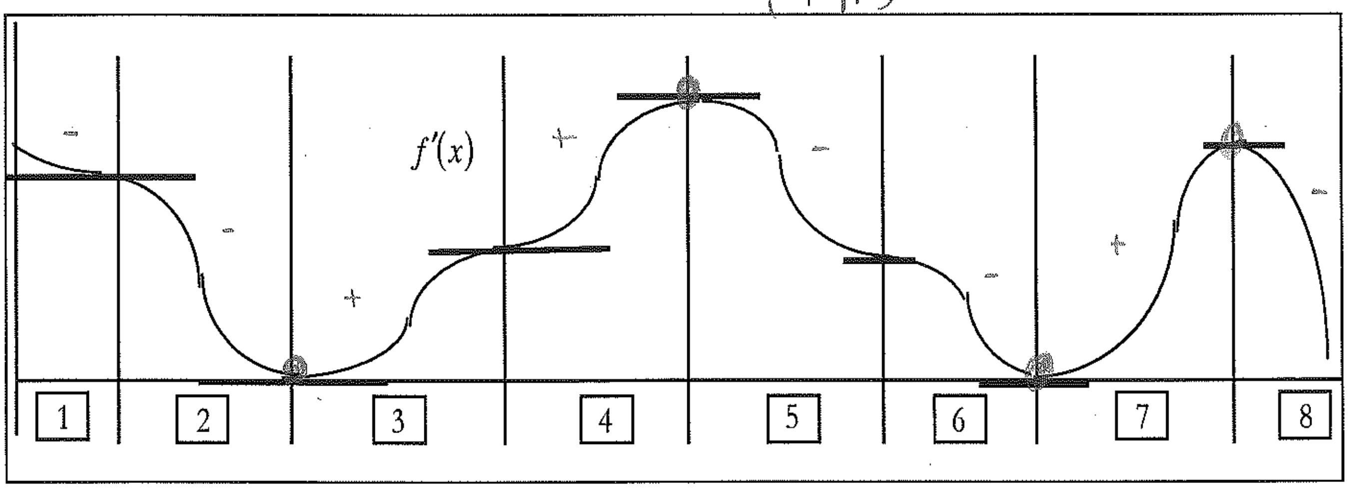
$f'(x) = (x^2+5x+6)(2(x+4)) + (x+4)^2(2x+5)$

$f'(-2) = ((-2)^2+5(-2)+6)(2(-2+4)) + (-2+4)^2(2(-2)+5)$

$= (4-10+6)(2\cdot 2) + (2^2)(-4+5) = 4(1) = \boxed{4}$

The answer is: __4__. Cross out that suspect number on your clue card and write # 20 as your set.

Location Problem: Below is a graph of $f'(x)$ (locations where the graph has horizontal tangents are indicated in bold). The graph has been divided into 8 partitions. If U represents the number of partitions $f(x)$ is concave up, D represents the number of partitions $f(x)$ is concave down, and I represents the number of inflection points of $f(x)$, find the value of $I+D-U$. U concave up $f''+$ (slope of f') = 3 D cc↓ $f''-$ = 5



I inflection pts f'' changes sign 4 $I+D-U = 4+5-3 = 6$

The answer is: __6__. Cross out that location number on your clue card and write # 20 as your set.

Treasure Problem: Find the volume if the graph of $y=\sqrt{\dfrac{20}{\pi}}\,e^{\frac{x}{2}}$ is rotated about the x-axis from $x=\ln\left(\dfrac{1}{2}\right)$ to $x=0$. Cross section is ⊙ $A(x) = \pi\left(\sqrt{\frac{20}{\pi}}\,e^{\frac{x}{2}}\right)^2$

$V = \pi \int_{\ln(1/2)}^{0} \left(\sqrt{\frac{20}{\pi}}\,e^{x/2}\right)^2 dx$

$V = \pi \int_{\ln 1/2}^{0} \frac{20}{\pi} e^{x}\,dx = \cancel{\pi}\frac{20}{\cancel{\pi}} \int_{\ln 1/2}^{0} e^{x}\,dx = 20\, e^{x}\Big|_{\ln 1/2}^{0} = 20\left(e^{0} - e^{\ln 1/2}\right)$

$= 20\left(1-\frac{1}{2}\right) = 10$

The answer is: __10__. Cross out that treasure number on your clue card and write # 20 as your set.

 Stu Schwartz

AB Clue Problem Set # 21 Solutions

Suspect Problem: If $f(x)=\left[e^x+\ln(2x)\right]^2$, find $f'(0.8)$ to the nearest integer.

$$f'(x)=2\left[e^x+\ln(2x)\right]\left(e^x+\frac{1}{x}\right)$$
$$f'(.8)=2\left[e^{.08}+\ln(1.6)\right]\left(e^{0.8}+1.25\right)=18.737\approx 19$$

The answer is 19.

Location Problem: If $f(x)=\begin{cases}9-x, x>\dfrac{41}{3}\\ \dfrac{x-a}{2}, x\le\dfrac{41}{3}\end{cases}$, what value of a allows $f(x)$ to be continuous?

$$\lim_{x\to\frac{41}{3}^+} f(x)=\frac{-14}{3} \qquad \lim_{x\to\frac{41}{3}^-} f(x)=\frac{\frac{41}{3}-a}{2}$$
$$\frac{-14}{3}=\frac{\frac{41}{3}-a}{2}\to 41-3a=-28$$
$$3a=69\Rightarrow a=23$$

The answer is 23.

Treasure Problem: If $f(x)=17x+x\sin^{-1}x+\sqrt{1-x^2}$, find $f'(0.85)$ to the nearest integer.

$$f'(x)=17+\frac{x}{\sqrt{1-x^2}}+\sin^{-1}x-\frac{x}{\sqrt{1-x^2}}$$
$$f'(x)=17+\sin^{-1}x$$
$$f'(0.85)=18.016$$

The answer is 18.

AB Clue Problem Set # 21

Suspect Problem: If $f(x)=\left[e^{x}+\ln(2x)\right]^{2}$, find $f'(0.8)$ to the nearest integer.

$f'(x) = 2\left[e^x + \ln(2x)\right]^1 \cdot \left[e^x + \frac{1}{\cancel{2}x}\cdot\cancel{2}\right]$

$f'(0.8) = 2\left[e^{.8} + \ln(1.6)\right]\left(e^{.8} + \frac{1}{.8}\right)$ ← watch parenthesis here!

$= 18.737 \approx 19$

The answer is: 19. Cross out that suspect number on your clue card and write # 21 as your set.

Location Problem: If $f(x)=\begin{cases} 9-x, x>\frac{41}{3} \\ \frac{x-a}{2}, x\le\frac{41}{3} \end{cases}$, what value of a allows $f(x)$ to be continuous?

$9 - \frac{41}{3} = \frac{\frac{41}{3} - a}{2}$

$2\left(9 - \frac{41}{3}\right) = \frac{41}{3} - a$

$18 - \frac{82}{3} = \frac{41}{3} - a$

$18 - \frac{123}{3} = -a$

$18 - 41 = -a$

$a = \overset{3}{\cancel{4}}1 - 18$

$a = 23$

The answer is: 23. Cross out that location number on your clue card and write # 21 as your set.

Treasure Problem: If $f(x)=17x+x\sin^{-1}x+\overset{(1-x^2)^{1/2}}{\sqrt{1-x^{2}}}$, find $f'(0.85)$ to the nearest integer.

$f'(x) = 17 + x\left(\frac{1}{\sqrt{1-x^2}}\right) + \sin^{-1}(x) + \frac{1}{\cancel{2}\sqrt{1-x^2}}(-\cancel{2}x)$

$f'(0.85) = 17 + \cancel{\frac{0.85}{\sqrt{1-.85^2}}} + \sin^{-1}(.85) - \cancel{\frac{.85}{\sqrt{1-.85^2}}}$

$= 17 + \sin^{-1}(.85) = 18.016 \approx 18$

The answer is: 18. Cross out that treasure number on your clue card and write # 21 as your set.

 Stu Schwartz

AB Clue Problem Set # 22 Solutions

Suspect Problem: Given $f(x) = 2x^2 + x - 3$, find $\lim\limits_{\Delta x \to 0} \dfrac{f(5+\Delta x) - f(5)}{\Delta x}$

$$\boxed{\begin{array}{l} f'(x) = 4x + 1 \\ f'(5) = 4(5) + 1 = 21 \end{array}}$$

The answer is 21.

Location Problem: Let R be the region bounded by $y = \dfrac{x\sqrt{5}}{5}$, $x = 15.12$, and the x-axis. R is rotated about the x-axis. To the nearest integer, find the value of k such that the line $x = k$ divides R into two equal volumes.

$$\boxed{\begin{array}{l} V = \pi \displaystyle\int_0^{15.12} \frac{x^2}{5}\, dx = 230.443\pi \\ V = \pi \displaystyle\int_0^{k} \frac{x^2}{5}\, dx = \frac{230.443}{2}\pi \\ \left.\dfrac{\pi x^3}{15}\right]_0^k = \dfrac{k^3}{15} = 115.222\pi \\ k^3 = 1728.325 \\ k = 12.001 \end{array}}$$

The answer is 12.

Treasure Problem: Find $\displaystyle\int_0^1 \frac{90}{2+9x^2}\, dx$ to the nearest integer.

$$\boxed{\begin{array}{l} u = 3x, a = \sqrt{2}, du = 3dx \\ \dfrac{1}{3}\displaystyle\int_0^1 \frac{90}{2+9x^2}\, 3dx \\ \left[30\left(\dfrac{1}{\sqrt{2}}\right)\tan^{-1}\left(\dfrac{3x}{\sqrt{2}}\right)\right]_0^1 \\ \dfrac{30}{\sqrt{2}}\tan^{-1}\left(\dfrac{3}{\sqrt{2}}\right) = 23.977 \approx 24 \end{array}}$$

The answer is 24.

AB Clue Problem Set # 22

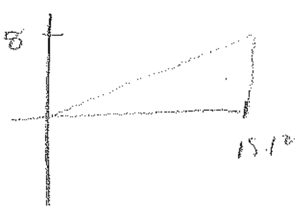
Suspect Problem: Given $f(x)=2x^2+x-3$, find $\lim\limits_{\Delta x\to 0}\dfrac{f(5+\Delta x)-f(5)}{\Delta x}$ ← means find $f'(5)$ Slope formula!

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

$f'(5)=4(5)+1=21$

The answer is: 21**. Cross out that suspect number on your clue card and write # 22 as your set.**

Location Problem: Let R be the region bounded by $y=\dfrac{x\sqrt{5}}{5}$, $x = 15.12$, and the x-axis. R is rotated about the x-axis. To the nearest integer, find the value of k such that the line $x = k$ divides R into two equal volumes.



$2\,\frac{\pi}{5}\int_0^k x^2\,dx = \frac{\pi}{5}\int_0^{15.12} x^2\,dx$

$\frac{2\pi}{5}\left[\frac{x^3}{3}\Big|_0^k\right] = \frac{\pi}{5}\left[\frac{x^3}{3}\Big|_0^{15.12}\right]$

$\frac{2\pi}{5}\cdot\frac{k^3}{3} = \frac{\pi}{5}\cdot\frac{15.12^3}{3}$

$\frac{2k^3}{3} = \frac{15.12^3}{3}$

$2k^3 = 15.12^3$

$k = \sqrt[3]{\frac{15.12^3}{2}}$

$k \approx 12.001$

Cross section is a circle

$A(x) = \pi\left(\frac{x\sqrt{5}}{5}\right)^2$

$A(x) = \pi\,\frac{5x^2}{25} = \pi\,\frac{x^2}{5} = \frac{\pi}{5}x^2$

The answer is: 12**. Cross out that location number on your clue card and write # 22 as your set.**

Treasure Problem: Find $\int_0^1 \dfrac{90}{2+9x^2}\,dx$ to the nearest integer.

★ Recall $\frac{d}{dx}(\tan x) = \frac{1}{1+u^2}$

$\int_0^1 \frac{90}{2}\left(\frac{1}{1+\frac{9x^2}{2}}\right)dx$

let $u = \frac{3x}{\sqrt{2}}$

$du = \frac{3}{\sqrt{2}}\,dx$ $\quad u(0)=0 \quad u(1)=3/\sqrt{2}$

$= \frac{\overset{30}{90}}{2}\left(\frac{\sqrt{2}}{3}\right)\int_0^1\left(\frac{3}{\sqrt{2}}\right)\frac{1}{1+\left(\frac{3x}{\sqrt{2}}\right)^2}\,dx = \frac{30\sqrt{2}}{2}\int_0^{3/\sqrt{2}}\frac{1}{1+u^2}\,du = 15\sqrt{2}\left[\tan^{-1}(3/\sqrt{2}) - \tan^{-1}(0)\right]$

$\approx 23.977 \approx \boxed{24}$

The answer is: 24**. Cross out that treasure number on your clue card and write # 22 as your set.**

Stu Schwartz

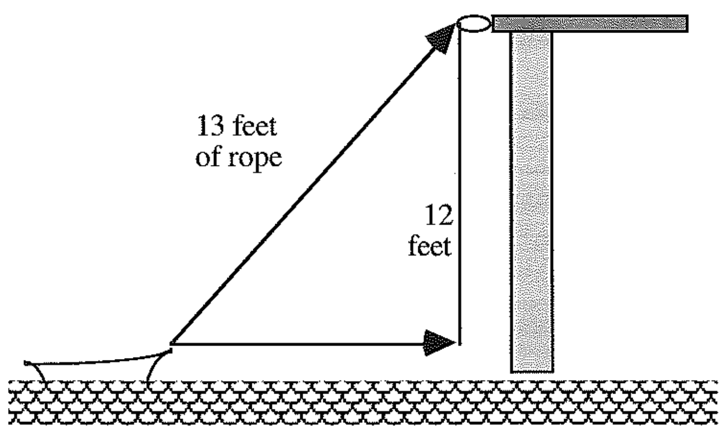
AB Clue Problem Set # 23 Solutions

Suspect Problem: The function $f(x) = 5x^4 - 10x^3 + \frac{4}{x^2} + 45$ has a tangent line at $x = 2$ in the form of $y = ax + b$. Find the value of $a + b$.

$$\boxed{\begin{aligned}
&f(2) = 5(2)^4 - 10(2)^3 + \frac{4}{(2)^2} + 45 = 46\\
&f'(x) = 20x^3 - 30x^2 - \frac{8}{x^3} \Rightarrow f'(2) = 160 - 120 - 1 = 39\\
&y - 46 = 39(x-2) \Rightarrow y - 46 = 39x - 78\\
&y = 39x - 32 \Rightarrow a + b = 39 - 32 = 7
\end{aligned}}$$

The answer is 7.

Location Problem: A rowboat is pulled toward a dock from the bow through a ring on the dock 12 feet above the bow. If the rope is hauled in at $\frac{10}{13}$ ft/sec, how fast is the boat approaching the dock when 13 feet of rope are out?



$$\boxed{\begin{aligned}
&x^2 + y^2 = z^2\\
&x^2 + 144 = z^2\\
&2x\frac{dx}{dt} = 2z\frac{dx}{dt}\\
&5\frac{dx}{dt} = 13\left(\frac{10}{13}\right)\\
&\frac{dx}{dt} = 2 \text{ ft/sec}
\end{aligned}}$$

The answer is 2.

Treasure Problem: Find $\int_e^{e^7} \frac{16}{x\ln(4x)}\,dx$ to the nearest integer.

$16\int_{1+\ln 4}^{7+\ln 4} \frac{1}{u}\,du$	$u = \ln(4x), du = \frac{1}{x}dx$
$16[\ln u]_{1+\ln 4}^{7+\ln 4}$	$x = e, u = \ln 4e = 1 + \ln 4$
$16[\ln(7+\ln 4) - \ln(1+\ln 4)] = 16\ln\left(\frac{7+\ln 4}{1+\ln 4}\right) = 20.110 \approx 20$	$x = e^7, u = \ln\left(4e^7\right) = 7 + \ln 4$

The answer is 20.

 Stu Schwartz

AB Clue Problem Set # 23

Suspect Problem: The function $f(x) = 5x^4 - 10x^3 + \frac{4}{x^2} + 45$ has a tangent line at $x = 2$ in the form of $y = ax + b$. Find the value of $a + b$.

$4x^{-2}$

$f'(x) = 20x^3 - 30x^2 - 8x^{-3}$

$f'(2) = 160 - 120 - \frac{8}{8}$

slope of tangent $= 39$

pt $(2, f(2)) = (2, 1)$

$f(2) = 5 \cdot 2^4 - 10(2^3) + \frac{4}{2^2} + 45$

$= 80 - 80 + 1 + 45 = 46$

$y = 39(x-2) + 46$

$y = 39x - 78 + 46$

$y = 39x - 32$

$a + b = 39 + -32 = 7$

The answer is: 7. Cross out that suspect number on your clue card and write # 23 as your set.

Location Problem: A rowboat is pulled toward a dock from the bow through a ring on the dock 12 feet above the bow. If the rope is hauled in at $\frac{10}{13}$ ft/sec, how fast is the boat approaching the dock when 13 feet of rope are out?

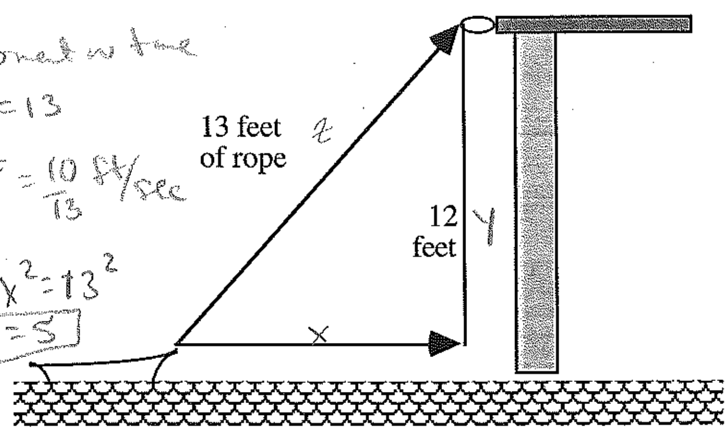
moment in time

$z = 13$

$\frac{dz}{dt} = \frac{10}{13}$ ft/sec

$12^2 + x^2 = 13^2$

$\boxed{x = 5}$



$x^2 + 12^2 = z^2$

Find $\frac{dx}{dt}$ when $z = 13$

$\cancel{2}x \frac{dx}{dt} = \cancel{2}z \frac{dz}{dt}$

$5 \frac{dx}{dt} = 13\left(-\frac{10}{13}\right)$

$5 \frac{dx}{dt} = -10$

$\frac{dx}{dt} = -2$ ft/sec means distance b/twn boat & dock decreasing

The answer is: 2. Cross out that location number on your clue card and write # 23 as your set.

Treasure Problem: Find $\int_e^{e^7} \frac{16}{x\ln(4x)}\,dx$ to the nearest integer.

$= 16 \int_e^{e^7} \frac{1}{x \ln(4x)}\,dx$

$u = \ln 4x$

$du = \frac{1}{x}\,dx$

$u(e) = \ln 4e = \ln 4 + \ln e = \ln 4 + 1$

$u(e^7) = \ln 4e^7 = \ln 4 + 7\ln e = \ln 4 + 7$

$= 16 \int_e^{e^7} \frac{1}{u}\,du$

$= 16 \left[\ln u \Big|_{\ln 4 + 1}^{\ln 4 + 7} \right]$

$16 \left[\ln(\ln 4 + 7) - \ln(\ln 4 + 1) \right]$

$= 20.110 \approx 20$

The answer is: 20. Cross out that treasure number on your clue card and write # 23 as your set.

Stu Schwartz

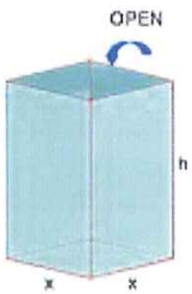
AB Clue Problem Set # 24 Solutions

Suspect Problem: Given $f(x) = \left(2x^2 - 3x + 4\right)^2$, find $\left|f'(.05) + f'(.45)\right|$ and round to the nearest integer.

$$\boxed{\begin{aligned}
&f'(x) = 2\left[2x^2 - 3x + 4\right]\left[4x - 3\right]\\
&f'(.05) = 2\left[2(.05)^2 - 3(.05) + 4\right]\left[4(.05) - 3\right] = -21.588\\
&f'(.45) = 2\left[2(.45)^2 - 3(.45) + 4\right]\left[4(.45) - 3\right] = -7.332\\
&\left|f'(.05) + f'(.45)\right| = \left|-21.588 - 7.332\right| = \left|-28.92\right| = 28.92 \approx 29
\end{aligned}}$$

The answer is 29.

Location Problem: An open box with a square base has to be constructed with surface area of 500 square inches. To the nearest integer, find the length of the base of the box with maximum volume.



$$\boxed{\begin{aligned}
&V = x^2 h && S = x^2 + 4xh = 500\\
&V = x^2\left(\frac{500 - x^2}{4x}\right) && h = \frac{500 - x^2}{4x}\\
&V = 125x - \frac{x^3}{4}\\
&\frac{dV}{dt} = 125 - \frac{3x^2}{4} = 0\\
&3x^2 = 500\\
&x = 12.910 \approx 13
\end{aligned}}$$

The answer is 13.

Treasure Problem: Use the trapezoid method to find the area to the nearest integer under the function $f(x) = 2\sqrt{x} + 4.25$ on [0, 4] using 4 trapezoids.

$$\boxed{\begin{aligned}
&f(x) = 2\sqrt{x} + 4.25\\
&A = \frac{1}{2}(1)\left[f(0) + 2f(1) + 2f(2) + 2f(3) + f(4)\right]\\
&A = \frac{1}{2}\left[4.25 + 2(6.25) + 2(7.078) + 2(7.714) + 8.25\right]\\
&A = \frac{1}{2}(55.584) = 27.292 \approx 27
\end{aligned}}$$

The answer is 27.

AB Clue Problem Set # 24

Suspect Problem: Given $f(x) = (2x^2 - 3x + 4)^2$, find $|f'(.05) + f'(.45)|$ and round to the nearest integer.

$f'(x) = 2(2x^2 - 3x + 4)(4x - 3)$

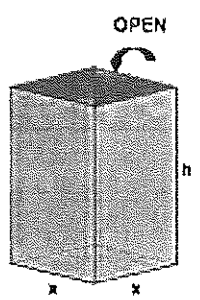
$f'(.05) = 2(2(.05^2) - 3(.05) + 4)(4(.05) - 3) = -21.59$

$f'(.45) = 2(2(.45^2) - 3(.45) + 4)(4(.45) - 3) = -7.332$

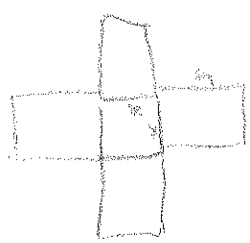
$|f'(.05) + f'(.45)| = |-21.59 + -7.332| = 28.912 \approx 29$

The answer is: 29. Cross out that suspect number on your clue card and write # 24 as your set.

Location Problem: An open box with a square base has to be constructed with surface area of 500 square inches. To the nearest integer, find the length of the base of the box with maximum volume.



net to find S.A formula



$SA = x^2 + 4xh$

$500 = x^2 + 4xh$

$\frac{500 - x^2}{4x} = h$

maximize volume

$V(x) = x \cdot x \cdot h$

$V(x) = x^2\left(\frac{500 - x^2}{4x}\right)$

$V(x) = \frac{500x - x^3}{4}$

$V(x) = 125x - \frac{1}{4}x^3$

$\frac{dy}{dx} = 125 - \frac{3}{4}x^2$

$0 = 125 - \frac{3}{4}x^2$

$\left(\frac{4}{3}\right)\frac{3}{4}x^2 = 125\left(\frac{4}{3}\right)$

$x^2 = \frac{500}{3}$

$x = \sqrt{500/3} \approx 12.910$

$V'(1) + \quad | \quad V'(15) -$

12.910

$x \approx 13$

The answer is: 13. Cross out that location number on your clue card and write # 24 as your set.

Treasure Problem: Use the trapezoid method to find the area to the nearest integer under the function $f(x) = 2\sqrt{x} + 4.25$ on [0, 4] using 4 trapezoids. $A = \frac{1}{2} \cdot h\,(b_1 + b_2)$

Trap area $= \frac{1}{2}(1)(f(0) + f(1)) + \frac{1}{2}(1)(f(1) + f(2)) + \frac{1}{2}(1)(f(2) + f(3)) + \frac{1}{2}(1)(f(3) + f(4))$

$= \frac{1}{2}[f(0) + 2f(1) + 2f(2) + 2f(3) + f(4)]$

$= \frac{1}{2}[4.25 + 2(6.25) + 2(7.0784) + 2(7.7141) + 8.25]$

$= \frac{1}{2}(54585) = 27.2925 \approx 27$

The answer is: 27. Cross out that treasure number on your clue card and write # 24 as your set.

Stu Schwartz

AB Clue Problem Set # 25 Solutions

Suspect Problem: Given $f(x) = x^3 + 2x - 1$, find $\dfrac{1}{\left[f^{-1}\right]'(2)}$. ... that is, find the reciprocal of the derivative of $f^{-1}(x)$ at $x = 2$

$$\boxed{\begin{array}{l} y = x^3 + 2x - 1 \qquad \text{Inverse}: \; x = y^3 + 2y - 1 = 2 \\ y^3 + 2y = 3 \Rightarrow y = 1 \\ 1 = \left(3y^2 + 2\right)\dfrac{dy}{dx} \\ \left.\dfrac{dy}{dx}\right|_{y=1} = \dfrac{1}{3y^2 + 2} = \dfrac{1}{5} \Rightarrow \dfrac{1}{dy/dx} = 5 \end{array}}$$

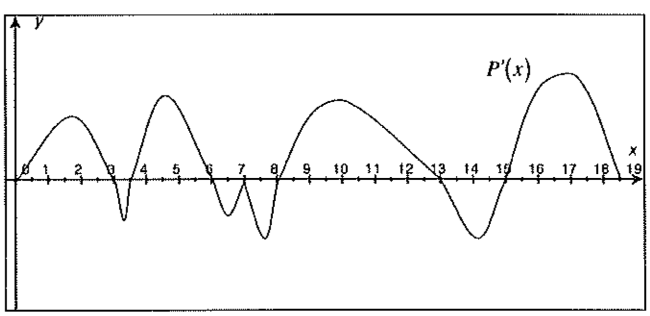
The answer is 5.

Location Problem: Given $x^2 + y^3 + y = 402$, find $\dfrac{dy}{dx}$ at $x = -20$.

$$\boxed{\begin{array}{l} 400 + y^3 + y = 402 \Rightarrow y^3 + y = 2 \Rightarrow y = 1 \\ 2x + 3y^2 \dfrac{dy}{dx} + \dfrac{dy}{dx} = 0 \\ \dfrac{dy}{dx}\left(3y^2 + 1\right) = -2x \\ \dfrac{dy}{dx} = \dfrac{-2x}{3y^2 + 1} = \dfrac{-2(-20)}{3 + 1} = \dfrac{40}{4} = 10 \end{array}}$$

The answer is 10.

Treasure Problem: An ant is moving up and down a wall with position function $P(x)$. The graph of $P'(x)$ is shown below with x measured in minutes. Calculate the total time the ant is moving upwards.



P' is positive on [0,3], [3.5,6], [8,13] and [15,18.5]. Therefore the total time that P is increasing is $3 + 2.5 + 5 + 3.5 = 14$.

The answer is 14.

 Stu Schwartz

AB Clue Problem Set # 25

Suspect Problem: Given $f(x)=x^3+2x-1$, find $\dfrac{1}{\left[f^{-1}\right]'(2)}$. ... that is, find the reciprocal of the derivative of $f^{-1}(x)$ at $x=2$

(graph calc, int.)

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

pt $(2, f^{-1}(2))$

$2=y^3+2y-1 \Rightarrow y=1$

$(2,1)$

$1=3y^2\frac{dy}{dx}+2\frac{dy}{dx}$

$\frac{1}{3y^2+2}=\frac{dy}{dx}$ at $x=2$ $\frac{dy}{dx}=\frac{1}{3(1^2)+2}=\frac{1}{5}$

$\boxed{\text{reciprocal is } 5}$

The answer is: 5. Cross out that suspect number on your clue card and write # 25 as your set.

Location Problem: Given $x^2+y^3+y=402$, find $\dfrac{dy}{dx}$ at $x=-20$.

① $2x+3y^2\frac{dy}{dx}+\frac{dy}{dx}=0$

$(3y^2+1)\frac{dy}{dx}=-2x$

② pt @ $x=-20$

$(-20,1)$

$(-20)^2+y^3+y=402$

$400+y^3+y=402$

$y(y^2+1)=2$

$y=1$ (by inspection)

③ $\frac{dy}{dx}=\frac{-2x}{3y^2+1}=\frac{-2(-20)}{3(1^2)+1}=\frac{40}{4}=\boxed{10}$

The answer is: 10. Cross out that location number on your clue card and write # 25 as your set.

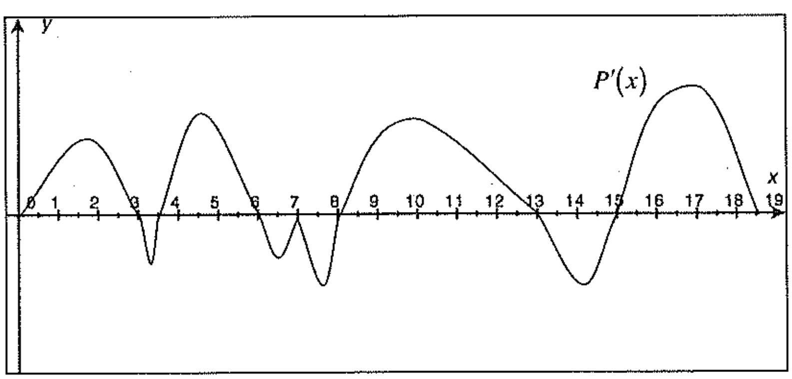
Treasure Problem: An ant is moving up and down a wall with position function $P(x)$. The graph of $P'(x)$ is shown below with x measured in minutes. Calculate the total time the ant is moving upwards.

moving up when $P'(x)$ is +

$(0,3)\cup(3.5,6)\cup(8,13)\cup(15,18.5)=$

$3+2.5+5+3.5$

$=14$ minutes



The answer is: 14. Cross out that treasure number on your clue card and write # 25 as your set.

Stu Schwartz

AB Clue Problem Set # 26 Solutions

Suspect Problem: If $f(x)=\dfrac{x^3+2x+6}{5x+3}$, find $f'(30)$ to the nearest integer.

$$f'(x)=\frac{(5x+3)(3x^2+2)-5(x^3+2x+6)}{(5x+3)^2}$$
$$f'(30)=\frac{153(2702)-5(27000+60+6)}{(153)^2}$$
$$f'(30)=\frac{413406-135330}{23409}=\frac{278076}{23409}=11.878\approx 12$$

The answer is 12.

Location Problem: The velocity function $v(t)$ given by $\dfrac{t^4}{12}-\dfrac{13t^3}{6}+20t^2+4t-2$. The change of velocity is decreasing on the interval (a,b). Find the value of $3a-b$.

$$\text{change of velocity } =v'(t)=\frac{t^3}{3}-\frac{13t^2}{2}+40t+4$$
$$v''(t)=t^2-13t+40=0$$
$$(t-5)(t-8)=0\Rightarrow t=5,8$$
$$a=5,b=8\Rightarrow 3a-b=15-8=7$$

$v''(t)$	+ + + + + + + +	0	- - - - - - - - - - - - -	0	+ + + + + +
		5		8	

The answer is 7.

Treasure Problem: If $F(x)=\displaystyle\int\frac{dx}{\sqrt{5-2x^2}}$ and $F(0)=10$, Find $F\left(\sqrt{2}\right)$ to the nearest integer.

$$a=\sqrt{5},u=x\sqrt{2},du=\sqrt{2}dx$$
$$F(x)=\int\frac{dx}{\sqrt{5-2x^2}}=\frac{1}{\sqrt{2}}\int\frac{\sqrt{2}dx}{\sqrt{5-2x^2}}=\frac{1}{\sqrt{2}}\sin^{-1}\left(\frac{x\sqrt{2}}{\sqrt{5}}\right)+C$$
$$F(0)=C=10$$
$$F(x)=\frac{1}{\sqrt{2}}\sin^{-1}\left(\frac{x\sqrt{2}}{\sqrt{5}}\right)+10$$
$$F\left(\sqrt{2}\right)=\frac{1}{\sqrt{2}}\sin^{-1}\left(\frac{\sqrt{2}\sqrt{2}}{\sqrt{5}}\right)+10=\frac{1}{\sqrt{2}}\sin^{-1}\left(\frac{2}{\sqrt{5}}\right)+10=10.783\approx 11$$

The answer is 11.

AB Clue Problem Set # 26

Suspect Problem: If $f(x)=\dfrac{x^3+2x+6}{5x+3}$, find $f'(30)$ to the nearest integer.

$$f'(x)=\frac{(5x+3)(3x^2+2)-(x^3+2x+6)(5)}{(5x+3)^2}$$

$$f'(30)=\frac{(5\cdot 30+3)(3(30^2)+2)-(30^3+2(30)+6)(5)}{(5\cdot 30+3)^2}$$

$$=\frac{153(2702)-(27000+60+6)(5)}{153^2}=11.88\approx 12$$

The answer is: 12. Cross out that suspect number on your clue card and write # 26 as your set.

Location Problem: The velocity function $v(t)$ given by $\dfrac{t^4}{12}-\dfrac{13t^3}{6}+20t^2+4t-2$. The change of velocity is decreasing on the interval (a,b). Find the value of $3a-b$.

$$v(t)=\frac{t^4}{12}-\frac{13t^3}{6}+20t^2+4t-2$$

change in velocity $v'(t)=\frac{4t^3}{12}-\frac{3\cdot 13t^2}{6}+2\cdot 20t+4$

shows decrease in $v(t)$ $v''(t)=t^2-13t+40$

$$0=(t-8)(t-5)$$

$t=8 \quad t=5$

interval $(5,8)$

(a,b)

$3a-b=3(5)-8$

$=15-8$

$=7$

The answer is: 7. Cross out that location number on your clue card and write # 26 as your set.

Treasure Problem: If $F(x)=\displaystyle\int\frac{dx}{\sqrt{5-2x^2}}$ and $F(0)=10$, Find $F(\sqrt{2})$ to the nearest integer.

Recall $\frac{d}{dx}\sin^{-1}(x)=\frac{1}{\sqrt{x-a^2}}$

$$F(x)=\int\frac{1}{\sqrt{5-2x^2}}\,dx$$

$$=\int\frac{1}{\sqrt{5(1-\frac{2}{5}x^2)}}\,dx$$

$$=\int\frac{1}{\sqrt{5}}\cdot\frac{1}{\sqrt{1-(\sqrt{\frac{2}{5}}x)^2}}\,dx$$

$$\int\frac{1}{\cancel{\sqrt{5}}}\cdot\frac{\cancel{\sqrt{5}}}{\sqrt{2}}\cdot\frac{1}{\sqrt{1-(\sqrt{\frac{2}{5}}x)^2}}\,dx$$

$\boxed{\text{Let } u=\sqrt{\tfrac{2}{5}}\,x \quad du=\sqrt{\tfrac{2}{5}}\,dx}$

$$\frac{1}{\sqrt{2}}\int\frac{1}{\sqrt{1-u^2}}\,du$$

$$=\frac{1}{\sqrt{2}}\cdot\sin^{-1}\left(\sqrt{\tfrac{2}{5}}x\right)+c$$

$F(0)=10$ so $c=10$

$$F(x)=\frac{1}{\sqrt{2}}\cdot\sin^{-1}\left(\sqrt{\tfrac{2}{5}}\,x\right)+10$$

$$F(\sqrt{2})=\frac{1}{\sqrt{2}}\cdot\sin^{-1}\left(\frac{\sqrt{2}}{\sqrt{5}}\cdot\frac{\sqrt{2}}{1}\right)+10$$

$$\approx 10.783\approx 11$$

The answer is: 11. Cross out that treasure number on your clue card and write # 26 as your set.

Stu Schwartz

AB Clue Problem Set # 27 Solutions

Suspect Problem: Find $\displaystyle\int_0^{\frac{e-1}{2}} \frac{4}{2x+1}\,dx$

$$2\int_0^{\frac{e-1}{2}} \frac{2}{2x+1}\,dx = 2\int_1^e \frac{du}{u} \qquad u = 2x+1, du = 2dx$$

$$2\ln u\Big|_1^e \qquad x = \frac{e-1}{2}, u = e, x = 0, u = 1$$

$$2\ln e - 2\ln 1$$

$$2$$

The answer is 2.

Location Problem: Find the slope of the normal line to $y = \ln(15-x)$ at $x = 4$.

$$y' = \frac{-1}{15-x}$$

$$m = y'(4) = \frac{-1}{11}$$

$$m\perp = 11$$

The answer is 11.

Treasure Problem: Let $P(t)$ equal to number of students in a school (population 492) who have bought their lunch after t weeks. P is increasing at a rate proportional to 600 - P. If 300 students buy their lunch initially and 400 buy their lunch after 10 weeks, after how many weeks (nearest integer) will the entire student body buy lunch?

$$\frac{dP}{dt} = k(600-P)$$

$$\frac{dP}{600-P} = k\,dt$$

$$\frac{dP}{P-600} = -k\,dt$$

$$\ln|P-600| = -kt + C$$

$$P - 600 = Ce^{-kt}$$

$$P = 600 + Ce^{-kt}$$

$$300 = 600 + C \Rightarrow C = -300$$

$$P = 600 - 300e^{-kt}$$

$$400 = 600 - 300e^{-10k}$$

$$300e^{-10k} = 200$$

$$e^{-10k} = \frac{2}{3} \Rightarrow k = \frac{\ln\left(\frac{2}{3}\right)}{-10} \approx .041$$

$$P = 600 - 300e^{-.041t}$$

$$492 = 600 - 300e^{-.041t}$$

$$300e^{-.041t} = 108$$

$$e^{-.041t} = .36$$

$$t = \frac{\ln .36}{-.041} = 25.197 \approx 25$$

The answer is 25.

 Stu Schwartz

AB Clue Problem Set # 27

Suspect Problem: Find $\int_0^{\frac{e-1}{2}} \frac{4}{2x+1}\,dx$ $= 4\left(\frac{1}{2}\right)\int_0^{\frac{e-1}{2}} \frac{1}{2x+1}\,dx$

Let $u = 2x+1$
$du = 2\,dx$
$u(0) = 1$
$u\left(\frac{e-1}{2}\right) = 2\left(\frac{e-1}{2}\right)+1 = e$

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

$= 2\left[\ln u \Big|_1^e\right]$

$= 2\left[\ln e - \ln 1\right] = 2\left[1-0\right] = 2$

The answer is: 2. Cross out that suspect number on your clue card and write # 27 as your set.

Location Problem: Find the slope of the normal line to $y = \ln(15-x)$ at $x = 4$.

$y = \ln(15-x)$

$y' = \frac{1}{15-x}\cdot -1$

$y'(4) = \frac{-1}{15-4} = \frac{-1}{11}$

normal slope = 11

The answer is: 11. Cross out that location number on your clue card and write # 27 as your set.

Treasure Problem: Let $P(t)$ equal to number of students in a school (population 492) who have bought their lunch after t weeks. P is increasing at a rate proportional to 600 - P. If 300 students buy their lunch initially and 400 buy their lunch after 10 weeks, after how many weeks (nearest integer) will the entire student body buy lunch?

See 2nd sheet

The answer is: 25. Cross out that treasure number on your clue card and write # 27 as your set.

Given • Schools Population is 492 students

• $\frac{dP}{dt} = k(600-P)$ ⇐ P increasing at rate proportional to (600-P

• Pts 300 students buy lunch initially means

when $t=0$ $P(t)=300$

$t=10$ $P(t)=400$

• Question - How long (find t) when entire student body (492 students) buys lunch?

$$\frac{dP}{dt} = k(600-P)$$

$$\int \frac{1}{600-P}\,dP = \int k\,dt$$

$$-\ln(600-P) = kt + c$$

$$e^{\ln|(600-P)|} = e^{(-kt+c)}$$

$$|600-P| = e^{c}\cdot e^{-kt}$$

$$600-P = \pm C\cdot e^{kt}$$

When $t=0$ $P(t)=300$, Find C

$$600-300 = C\cdot e^{k(0)}$$

$$300 = C$$

$\boxed{\text{Equation}}$

$$600-P = 300e^{kt}$$

$\boxed{\text{Find k, use 2nd pt}}$

$$600-400 = 300e^{k(10)}$$

$$\frac{200}{300} = e^{10k}$$

$$\ln 2/3 = 10k$$

$$\boxed{\frac{\ln 2/3}{10} = k}$$

$\boxed{\text{Complete Equation}}$

$$600-P = 300e^{\frac{\ln 2/3}{10}t}$$

$$-P = -600 + 300e^{\frac{\ln 2/3}{10}t}$$

$$P = 600 - 300e^{\frac{\ln 2/3}{10}t}$$

$\frac{\ln 2/3}{10} \approx -.041$ sto → A

Answer question

$$P(t) = 600 - 300e^{-.041t}$$

$$492 = 600 - 300e^{-.041t}$$

$$-600 \quad -600$$

$$\frac{-108}{-300} = \frac{\cancel{-300}e^{-.041t}}{\cancel{-300}}$$

$$\ln(.36) = \ln(e^{-.041t})$$

$$\frac{\ln .36}{-.041} = \frac{\cancel{-.041}t}{\cancel{-.041}}$$

use stored value of A →

$$25.197 \approx t$$

AB Clue Problem Set # 28 Solutions

Suspect Problem: The graph of $x^2+4y^2-4x-12y+4=0$ has two points of horizontal tangency, (x_1,y_1) and (x_2,y_2). Find the value of $(x_1+y_1+x_2+y_2)(x_1,+x_2)$.

$$2x+8y\frac{dy}{dx}-4-12\frac{dy}{dx}=0$$
$$\frac{dy}{dx}(8y-12)=4-2x$$
$$\frac{dy}{dx}=\frac{4-2x}{8y-12}=0$$
$$4-2x=0 \Rightarrow x=2$$

$$4+4y^2-8-12y+4=0$$
$$4y(y-3)=0$$
$$y=0, y=3$$
Points are $(2,0),(2,3)$
$$(x_1+y_1+x_2+y_2)(x_1,+x_2)=(2+0+2+3)(2+2)=28$$

The answer is 28.

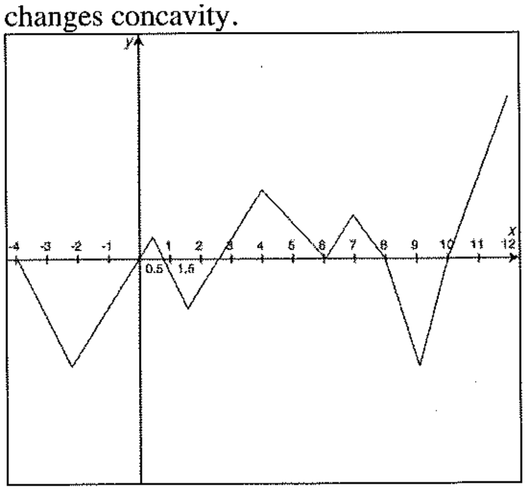
Location Problem: Given the following chart, find the derivative of $\frac{g(x)}{f(x)}-f[g(x)]$ at $x=3$.

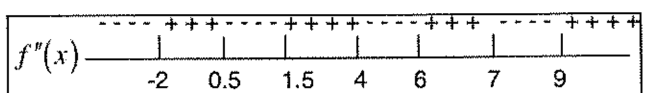
x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
3	1	9	-3	2
6	3	-2	4	5
9	-1	3	6	8

$$\frac{d}{dx}\left(\frac{g(x)}{f(x)}-f[g(x)]\right)=\frac{f(x)g'(x)-g(x)f'(x)}{[f(x)]^2}-f'[g(x)]g'(x)$$
$$\left.\frac{d}{dx}\right|_{x=3}\left(\frac{g(x)}{f(x)}-f[g(x)]\right)=\frac{f(3)g'(3)-g(3)f'(3)}{[f(3)]^2}-f'[g(3)]g'(3)=\frac{1(2)-9(-3)}{1^2}-f'(9)\cdot(2)=29-6(2)=17$$

The answer is 17.

Treasure Problem: Given the graph of $f'(x)$ below, find the sum of all the x-coordinates where the graph of f changes concavity.





$$-2+0.5+1.5+4+6+7+9=26$$

The answer is 26.

Stu Schwartz

AB Clue Problem Set # 28

$\frac{dy}{dx} = 0$

Suspect Problem: The graph of $x^2 + 4y^2 - 4x - 12y + 4 = 0$ has two points of horizontal tangency, (x_1, y_1) and (x_2, y_2). Find the value of $(x_1 + y_1 + x_2 + y_2)(x_1 + x_2)$.

① Find $\frac{dy}{dx}$

$2x + 8y\frac{dy}{dx} - 4 - 12\frac{dy}{dx} = 0$

$(8y - 12)\frac{dy}{dx} = 4 - 2x$

$\frac{dy}{dx} = \frac{4-2x}{8y-12}$

$0 = 4 - 2x$
$2x = 4$
$x = 2$

② Find pts where $x = 2$ in original eq

$2^2 + 4y^2 - 4(2) - 12y + 4 = 0$
$4 + 4y^2 - 8 - 12y + 4 = 0$
$4y^2 - 12y = 0$
$4y(y - 3) = 0$
$y = 0 \quad y = 3$

③ pts
$(2, 0) \quad (2, 3)$
$x_1\ y_1 \quad x_2\ y_2$

④ Find
$(x_1 + y_1 + x_2 + y_2)(x_1 + x_2)$
$(2 + 0 + 2 + 3)(2 + 2)$
$7 \cdot 4$
$= 28$

The answer is: 28. Cross out that suspect number on your clue card and write # 28 as your set.

Location Problem: Given the following chart, find the derivative of $\frac{g(x)}{f(x)} - f[g(x)]$ at $x = 3$.

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
3	1	9	-3	2
6	3	-2	4	5
9	-1	3	6	8

$\frac{g(x)}{f(x)} \cdot \frac{f(x)g'(x) - g(x)f'(x)}{f(x)^2}$

$= \frac{1 \cdot 2 - 9(-3)}{1}$

$= \frac{2+27}{1} = 29$

$f(g(x)) =$
$f'(g(3)) \cdot g'(3)$
$f'(9) \cdot g'(3)$
$6 \cdot 2 = 12$

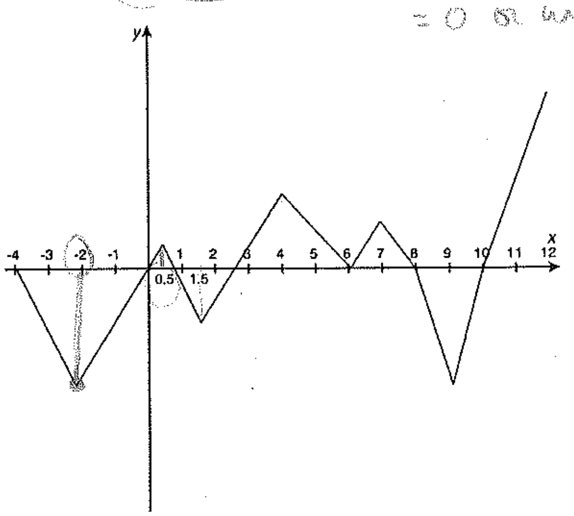
$29 - 12 = 17$

The answer is: 17. Cross out that location number on your clue card and write # 28 as your set.

Treasure Problem: Given the graph of $f'(x)$ below, find the sum of all the x-coordinates where the graph of f changes concavity.

$f''(x)$ changes sign $= 0$ or undefined

$f''(x)$ is slope of $f'(x)$



$-2 + .5 + 1.5 + 4 + 6 + 7 + 9$

$= 10 + 16$

$= 26$

The answer is: 26. Cross out that treasure number on your clue card and write # 28 as your set.

Stu Schwartz

AB Clue Problem Set # 29 Solutions

Suspect Problem: Given $f(x) = 2\sin(x^3)\cos(x^2)$, find $f'(4.585)$ to the nearest integer .

$$\boxed{\begin{aligned}
&f'(x) = 2\sin(x^3)(-\sin x^2)(2x) + \cos(x^2)2\cos(x^3)(3x^2)\\
&f'(x) = -4x(\sin x^2)\sin(x^3) + 6x^2\cos(x^2)\cos(x^3)\\
&f'(x) = -4(4.585)\sin(4.585)^2\sin(4.585)^3 + 6(4.585)^2\cos(4.585)^2\cos(4.585)^3 = 25.696 \approx 26
\end{aligned}}$$

The answer is 26.

Location Problem: Find the minimum y-value where the graph of $y = \dfrac{x^2-36}{x^2-4}$ is concave up.

$$y' = \frac{(x^2-4)(2x)-(x^2-36)(2x)}{(x^2-4)^2} = \frac{64x}{(x^2-4)^2}$$

y has a critical point at $x = 0$

$$y'' = \frac{64(x^2-4)^2 - 64x(2)(x^2-4)(2x)}{(x^2-4)^4} = \frac{64(x^2-4)\left[x^2-4-4x^2\right]}{(x^2-4)^4}$$

$$y'' = \frac{-64\left[3x^2+4\right]}{(x^2-4)^3} \qquad y(0) = \frac{0-36}{0-4} = 9$$

y': - - - - - - - - - - - - - - 0 + + + + + + + + + + + +
(-2, 0, 2)

y'': - - - - - - + + + + + + + + + + + + + - - - - - - -
(-2, 2)

The answer is 9.

Treasure Problem: Below is a table of $f(x)$. Find the positive difference in estimating $\int_1^{13} f(x)\,dx$ by using 6 left rectangles and 6 trapezoids.

x	1	2	3	4	5	6	7	8	9	10	11	12	13
$f(x)$	0	3	5	6	7	8	10	12	16	18	20	21	23

$$\boxed{\begin{aligned}
&\text{left rect}: 2(0+5+7+10+16+20) = 116\\
&\text{trap}: \frac{1}{2}(2)\left[0+2(5)+2(7)+2(10)+2(16)+2(20)+23\right] = 139\\
&\text{difference } = 139-116 = 23
\end{aligned}}$$

The answer is 23.

 Stu Schwartz

AB Clue Problem Set # 29

Suspect Problem: Given $f(x) = 2\sin(x^3)\cos(x^2)$, find $f'(4.585)$ to the nearest integer.

Product + chain rules

$f'(x) = 2\sin x^3 \cdot (-\sin(x^2)2x) + \cos x^2 \cdot (2\cos x^3(3x^2))$

watch ( )
store 4.585 as A
for easier input

$f'(4.585) = 25.696$

The answer is: 26. **Cross out that suspect number on your clue card and write # 29 as your set.**

Location Problem: Find the minimum y-value where the graph of $y = \dfrac{x^2-36}{x^2-4}$ is concave up.

$y' = \dfrac{(x^2-4)(2x) - (x^2-36)(2x)}{(x^2-4)^2}$

$0 = 64x$

$0 = x$

check sign here

$- \quad | \quad +$
$\quad\;\; 0$

$0 = \dfrac{2x^3 - 8x - [2x^3 - 72x]}{(x^2-4)^2}$

$y(0) = \dfrac{0^2-36}{0^2-4} = \dfrac{36}{4} = 9$

$0 = \cancel{2x^3} - 8x \cancel{-2x^3} + 72x$

The answer is: 9. **Cross out that location number on your clue card and write # 29 as your set.**

Treasure Problem: Below is a table for $f(x)$. Find the positive difference in estimating $\int_1^{13} f(x)\,dx$ by using 6 left rectangles and 6 trapezoids.

x	1	2	3	4	5	6	7	8	9	10	11	12	13
$f(x)$	0	3	5	6	7	8	10	12	16	18	20	21	23

Left

LRAM $= 2(0) + 2(5) + 2(7) + 2(10) + 2(16) + 2(20)$

$= 2(0+5+7+10+16+20) = 2(58) = \boxed{116}$

Trap $= \frac{1}{2}\cdot 2(0+5) + \frac{1}{2}\cdot 2(5+7) + \frac{1}{2}\cdot 2(7+10) + \frac{1}{2}(2)(10+16) + \frac{1}{2}\cdot 2(16+20) + \frac{1}{2}\cdot 2(20+23)$

$= 0 + 2(5) + 2(7) + 2(10) + 2(16) + 2(20) + 23$

$= \boxed{139}$

difference $139 - 116 = 23$

The answer is: 23. **Cross out that treasure number on your clue card and write # 29 as your set.**

 Stu Schwartz

AB Clue Problem Set # 30

Suspect Problem: Kenny Park takes 30 seconds to parallel park his car. The following tables give values of t in seconds and the velocity v of the car in ft/sec. Find the minimum number of times within the 30 seconds (inclusive) that the car was stopped.

1 2 3

t	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
v	4	2	1	-0.5	-2	-1	0	1	2	1	0.5	-1	-3	-2	-1	-0.5

sec
ft/sec

4 5 6 7 8 9

t	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
v	-0.5	0	-0.5	-0.5	-0.5	-1	-1	-0.5	0.5	-0.5	-1	-0.5	0.5	-0.5	0

stopped when $v(t)=0$ OR changes sign

The answer is: 9. Cross out that suspect number on your clue card and write # 30 as your set.

Location Problem: Let f be a function that is differentiable for all real numbers. The table below gives the values of f and its derivative f' for selected values of x in the interval $-1 \le x \le 0$. Using the equation of the line tangent to the graph of f where $x = -0.6$, approximate the value of $f(-0.8)$.

x	-1	-0.6	-0.2	0
$f(x)$	40	18	-5	-10
$f'(x)$	-40	-30	-10	1

Approximate $f(-0.8)$

$y = -30(-0.8 + 0.6) + 18$

$y = -30(-0.2) + 18$

$y = 6 + 18 = 24$

Tangent line @ $x = -0.6$

$m = -30$

pt $(-0.6, 18)$

$y - y_1 = m(x - x_1)$

$y - 18 = -30(x + 0.6)$

The answer is: 24 Cross out that location number on your clue card and write # 30 as your set.

Treasure Problem: Let $F(x) = 10\int_0^x \sin(t^2 - t + 1)\,dt$. Find the average rate of change of $F'(x)$ on [13.5, 14] to the nearest integer.

$F'(x) = \frac{d}{dx}\int_0^x 10\sin(t^2 - t + 1)\,dt = 10\sin(x^2 - x + 1)$

Average rate of change $\frac{f(b)-f(a)}{b-a} = \frac{10\sin(14^2 - 14 + 1) - 10\sin(13.5^2 - 13.5 + 1)}{14 - 13.5}$

$\approx 12.097 \approx \boxed{12}$

The answer is: 12. Cross out that treasure number on your clue card and write # 30 as your set.

Stu Schwartz

AB Clue Problem Set # 30 Solutions

Suspect Problem: Kenny Park takes 30 seconds to parallel park his car. The following tables give values of t in seconds and the velocity v of the car in ft/sec. Find the minimum number of times within the 30 seconds (inclusive) that the car was stopped.

t	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
v	4	2	1	-0.5	-2	-1	0	1	2	1	0.5	-1	-3	-2	-1	-0.5

t	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
v	-0.5	0	-0.5	-0.5	-0.5	-1	-1	-0.5	0.5	-0.5	-1	-0.5	0.5	-0.5	0

The car is stopped at the following times (sec): 6, 17, and 30.
According to the Intermediate Value Theorem, the car must have been stopped between seconds:
2 and 3, 10 and 11, 23 and 24, 24 and 25, 27 and 28, and 28 and 29.
So it was stopped a minimum of 9 times.

The answer is 9.

Location Problem: Let f be a function that is differentiable for all real numbers. The table below gives the values of f and its derivative f' for selected values of x in the interval $-1 \le x \le 0$. Using the equation of the line tangent to the graph of f where x = -0.6, approximate the value of $f(-0.8)$.

x	-1	-0.6	-0.2	0
$f(x)$	40	18	-5	-10
$f'(x)$	-40	-30	-10	1

$$y-18=-30(x+.6) \Rightarrow y=-30x$$
$$y(-0.8) \approx -30(-.8)=24$$

The answer is 24.

Treasure Problem: Let $F(x)=10\int_0^x \sin\left(t^2-t+1\right)dt$. Find the average rate of change of $F'(x)$ on [13.5, 14] to the nearest integer.

$$F'(x)=\frac{d}{dx}\int_0^x 10\sin\left(t^2-t+1\right)dt=10\sin\left(x^2-x+1\right)$$
$$\text{Avg. rate of change of } F'(x)=10\left[\frac{F'(14)-F'(13.5)}{14-13.5}\right]=10\left[\frac{\sin(183)-\sin(169.75)}{.5}\right]=12.097$$

The answer is 12.

 Stu Schwartz

AB Calculus - Clue Card

Directions: As you solve each problem, place the problem set number in the space provided to the right. When you solve all 29 sets of problems, the numbers which are blank represent the solution to the mystery. If you have duplicate answers, you know which problems to check.

Suspects	Set#
1. Barack Obama	4
2. Peyton Manning	27
3. Brad Pitt	13
4. Oprah	20
5. LeBron James	25
6. Tiger Woods	17
7. Britney Spears	23
8. Tim Tebow	3
9. Dr. House	30
10. Meryl Streep	16
11. Christine Aguilera	19
12. Dave Letterman	26
13. Pythagoras	18
14. Prince William	2
15. Tom Hanks	14
16. Mitt Romney	12
17. Bill Gates	11
18. Jessica Simpson	9
19. JK Rowling	21
20. Angelina Jolie	10
21. Hillary Clinton	22
22. Cameron Diaz	7
23. Roger Federer	5
24. Hannah Montana	8
25. Charles Barkley	6
26. Pawn Stars	29
27. Warren Buffett	1
28. Matt Lauer	28
29. Beyonce	24
30. Justin Bieber	15

Locations	Set#
1. Pearl Harbor	16
2. Eiffel Tower	23
3. Mt. McKinley	11
4. Times Square	3
5. Churchill Downs	15
6. White House	20
7. Egyptian Pyramids	26
8. Silicon Valley	17
9. Independence Hall	29
10. Old Faithful	25
11. Great Barrier Reef	27
12. WTC Memorial	22
13. Lincoln Memorial	24
14. Fort Knox	14
15. Stonehenge	9
16. Grand Canyon	7
17. Yankee Stadium	28
18. French Quarter	4
19. Appalachian Trail	8
20. Cape Canaveral	13
21. The Alamo	2
22. St. Louis Arch	18
23. Hoover Dam	21
24. Leaning Tower of Pisa	30
25. Alcatraz	1
26. Statue of Liberty	10
27. Golden Gate Bridge	6
28. Area 51	12
29. Mount Rushmore	19
30. Niagara Falls	5

Treasures	Set#
1. Stanley Cup	14
2. Crop Circles	12
3. Star Wars Light Saber	7
4. Health Care Reform	10
5. Ten Commandments	18
6. Declaration of Independence	17
7. Mona Lisa	19
8. Hope Diamond	11
9. Gold-encrusted iPhone	2
10. Olympic Gold Medal	20
11. A Utopian Island	26
12. 1st Place on American Idol	30
13. Proof of Fermat's Last Theorem	3
14. Anti-Gravity Device	25
15. Cure for cancer	8
16. Ark of the Covenant	13
17. Hydrogen based car	4
18. Rosetta Stone	21
19. A Worm Hole	9
20. Trip to Outer Space	23
21. Dorothy's ruby slippers	5
22. Crown Jewels of London	15
23. Google Stock	29
24. Waterless Washing Machine	22
25. Aladdin's Lamp	27
26. Master's Green Jacket	28
27. Noah's Ark	24
28. Mach 0.9 Private Jet	6
29. Water-Powered Battery	16
30. The Golden Goose	1

Dr House Won 1st Place on American Idol @ the Leaning Tower of Pisa!

Stu Schwartz