Exercise 1

These days it is possible to lease just about any car. For example, the modest fee of $1500 down plus $750 a month you can drive a jaguar. Unfortunately, those charges add up. Lease time will be x; total cost y.

a) What pattern will appear in a table showing total leasing cost as a function of number of months in the lease?

Lease time	0	1	2	3	4	5	6	7	8	← x
Total cost	1500	2250	3000	3750	4500	5250	6000	6750	7500	← y

The pattern will add $750 a month, starting with $1500 (the down payment.)

b. I would expect to see a consecutive increasing graph for this time and total paymunt.

c. $y = mx + b$ is the equation you would use because this is a linear problem. The y intercept, or b, equals 1500 (The total cost at 0) and m, or slope equals $\Delta y / \Delta x$ which is 750. Therefore $y = 750x + 1500$.

1500

Exercise 2

In 1975 a new ford mustang car had a base price of $4906. In 1981 a comparable car had a base price of $7900; in 1987 a base price of $9750 and in 1993, a base price of $13,245.

year	1975 (0)	1981 (6)	1987 (12)	1993 (18)	year = x
price	$4906	$7900	$9750	$13245	price = y

a) $y = mx + b$ and b is the y intercept which is the price (y) at 0. This number is $4906.

To find the slope, plug in x (year) and y (price) values and solve for m; use $9750 b/c it's in the middle.

$y = mx + b \rightarrow \$9750 = m(12) + 9906 \rightarrow y = 403.7x + 4906$

$m \approx \$403.67$

This slope of 403.7 tells that every 6 years the car price will on average increase (rise) about \$403.70 The b, or y intercept, was chosen because it was the y value closest to the middle of all y values and so it would give a better range.

b) $y = 403.7x + 4906$

If the year is 1978, it would be year 3; 1984 would be year 9; 1990 would be year 15; and 1994 year 19. So, with x being the year:

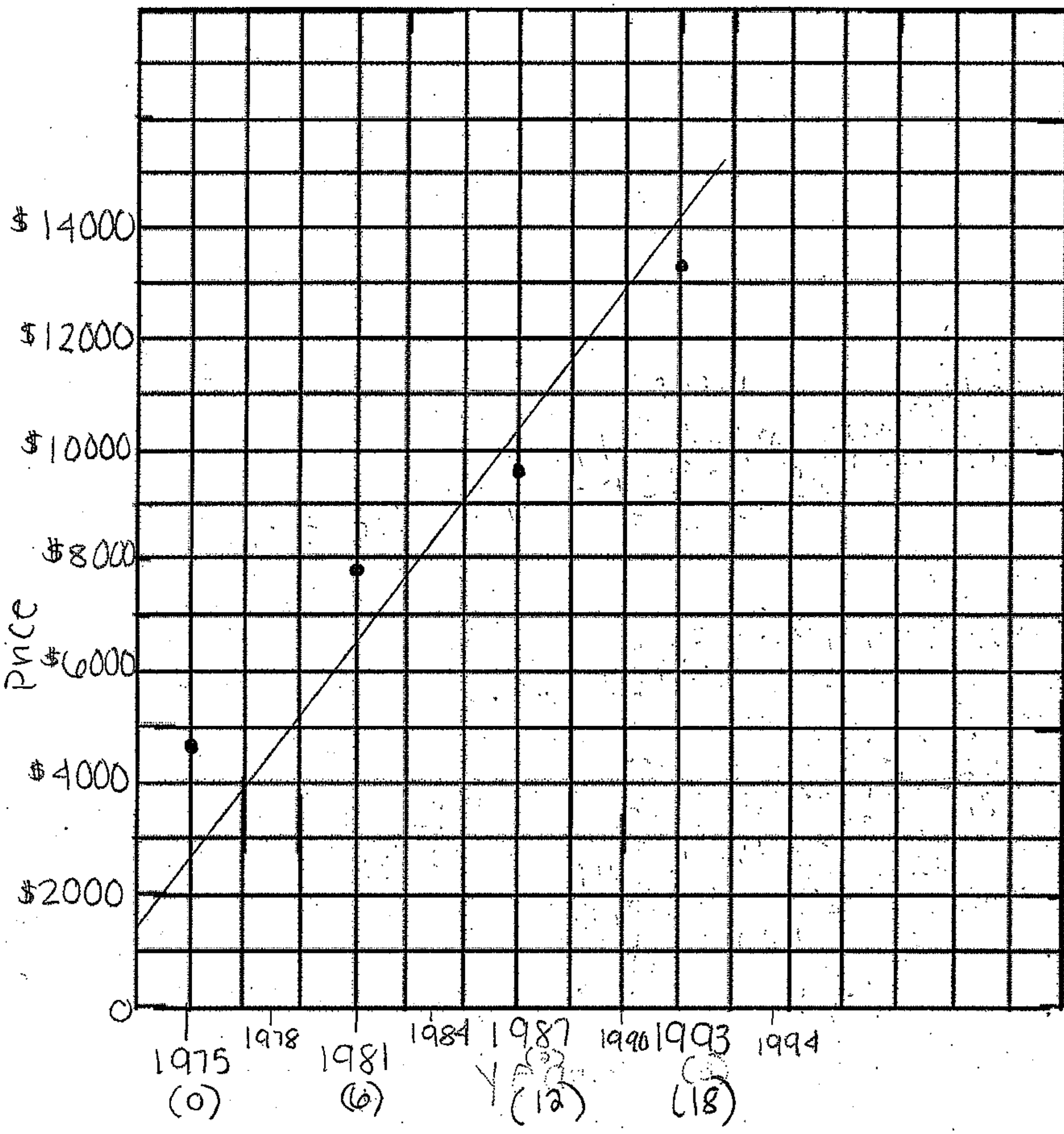
1978: $y = 403.7(3) + 4906 = \$6117.10$

1984: $y = 403.7(9) + 4906 = \$8539.30$

1990: $y = 403.7(15) + 4906 = \$10961.50$

1994: $y = 403.7(19) + 4906 = \$12576.30$

Conclusion: The estimated base price using my linear model would be \$6,117.10 in 1978; \$8539.30 in 1984; \$10961.50 in 1990; and \$12,576.30 in year 1994!


$14000
$12000
$10000
$8000
$6000
$4000
$2000
0
Price
1975
(0)
1978
1981
(6)
1984
1987
(12)
1990
1993
(18)
1994

$y = mx+b$

year

Exercise 3 : one of the amazing properties of mathematical ideas is that patterns discovered in one context turn up in quite different and unexpected places. Then calculations done the first time can be applied to the new situations. This recurrence of fundamental patterns is an especially impressive property of exponential models. For example, drugs are a very important part of the human health equation. Many drugs are essential in preventing and curing serious physical and mental illnesses; many other drugs cause damaging addiction and physical or mental impairment.

a. The half time of insulin appears to be 5 minutes because the original dose is at 10 and it is down to 5 units by 5 minutes.

*The pattern of decay shown on the graph for insulin can be modeled well by an exponential equation in the form of $y = A(b)^x$

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B.

T	0	1	2	3	4	5
U	10	8.9	7.6	6.5	5.9	5

(T = time since injection in minutes and U = units of insulin in blood)

T	0	1	2	3	4	5
U	10	8.9	7.6	6.5	5.9	5

0.89 0.85 0.86 0.90 0.85

Because 0.85 is the most persistant ratio, that is the one I will use for my ratio of $Y = A(b)^x \Rightarrow U = A(b)^T$, and A will be 10 because that is the y intercept. $U = 10(0.85)^T$ would be the functional equation. A difference equation would be $T_n = (0.85)T_{n-1}$.

C. If I test my rules I get the following result:

T	0	1	2	3	4	5
U	10	8.5	7.2	6.1	5.2	4.4
error	0	0.4	0.4	0.4	0.7	0.6

$U = 10(0.85)^t$

$$\left.\begin{array}{l} U = 10(0.85)^0 \\ U = 10(0.85)^1 \\ U = 10(0.85)^2 \\ U = 10(0.85)^3 \\ U = 10(0.85)^4 \\ U = 10(0.85)^5 \end{array}\right\} \text{calculate!}$$

x To get the Average error, I subtract and find the new values of U (units of insulin) by old values of U that came from the graph! my total error was only 2.5 which is not far off, indicating my equation fits the graph fairly well.

d. The value of A, which is the y intercept tells the initial amount of insulin units in the blood at 0 minutes. This means that A tells us where the action of the insulin of the blood begins. b, which I used r instead, told the ratio of the time since injection and the units of insulin in the blood. This letter r tells us that the action of insulin in the blood moves at a non-constant rate, as indicated by the graph and the fact I got different ratios.