Baldivis Secondary College

Year 11 Mathematics: Applications

Investigation 1, 2017

Topic – Finance

Take home component

Which Savings Account is Best?

Name : Anne Sirs Due : 13/2/2017

This assessment is in 2 parts.

Part One

This part of the investigation will be taken home and completed, then brought back to class a week later for discussion.

Part Two

A validation test will be given the day after the due date to determine your level of understanding for this investigation.

Compound Interest Formula

$A=P(1+r)^t$ Compounded Annually

$A=P(1+\frac{r}{n})^{nt}$ Compounded n times per year Where P= Principal, r= interest rate, t= term of loan in years

Part One

Situation 1

When twins Gemma and Holly were born, their grandparents opened a bank account for each of them. Each of the accounts started with $1000.

Gemma's account was to have $100 deposited into it on each of her birthdays (assume no interest is earned on this account).

Holly's account was to have interest of 5% per annum compounded on each of her birthdays. The girls were not allowed to withdraw any of the money from the accounts until they turned 50 years old.

Without doing any calculations, make some **predictions** about **which person** would be happiest with their account after 10 years, 20 years, 30 years, etc.

YOUR PREDICTION – Who will have the most money after

10 years Gemma

20 years Gemma

30 years Holly

40 years Holly

50 years Holly

A spreadsheet or table is a great way to calculate and display this type of information. Complete the spread sheet to show the amount (called the balance) in each girl's account over the first 30 years.

Spreadsheet showing the Bank Accounts for Gemma and Holly

Year	Gemma's Account	Holly's Account
0	$1 000.00	$1 000.00
1	1100	1050
2	1200	1102.5
3	1300	1157.63
4	1400	1215.51
5	1500	1276.28
6	1600	1340.10
7	1700	1407.10
8	1800	1477.46
9	1900	~~1511~~ 1551.33
10	2000	1628.89
11	2100	1710
12	2200	1795.86
13	2300	1885.65
14	2400	1979.93
15	2500	2078.93
16	2600	2182.87
17	2700	2292.02
18	2800	2406.62
19	2900	2526.95
20	3000	2653.30
21	3100	2785.96
22	3200	2925.26
23	3300	3071.52
24	3400	3225.10
25	3500	3386.35
26	3600	3555.67
27	3700	3733.46
28	3800	3920.13
29	3900	4116.14
30	4000	4321.94

Consider whether the amounts in each column are increasing by addition or by multiplication.

Without calculating the balance, how would you determine the Gemma's balance after;

35 years

$1000 + 100 \times 35$

42 years

$1000 + 100 \times 42$

51 years

$1000 + 100 \times 51$

Write an expression to show the balance of Gemma's account after n years.

$1000 + 100n$

Without calculating the balance, how would you determine the Holly's balance after;

35 years

$1000(1.05)^{35}$

42 years

$1000(1.05)^{42}$

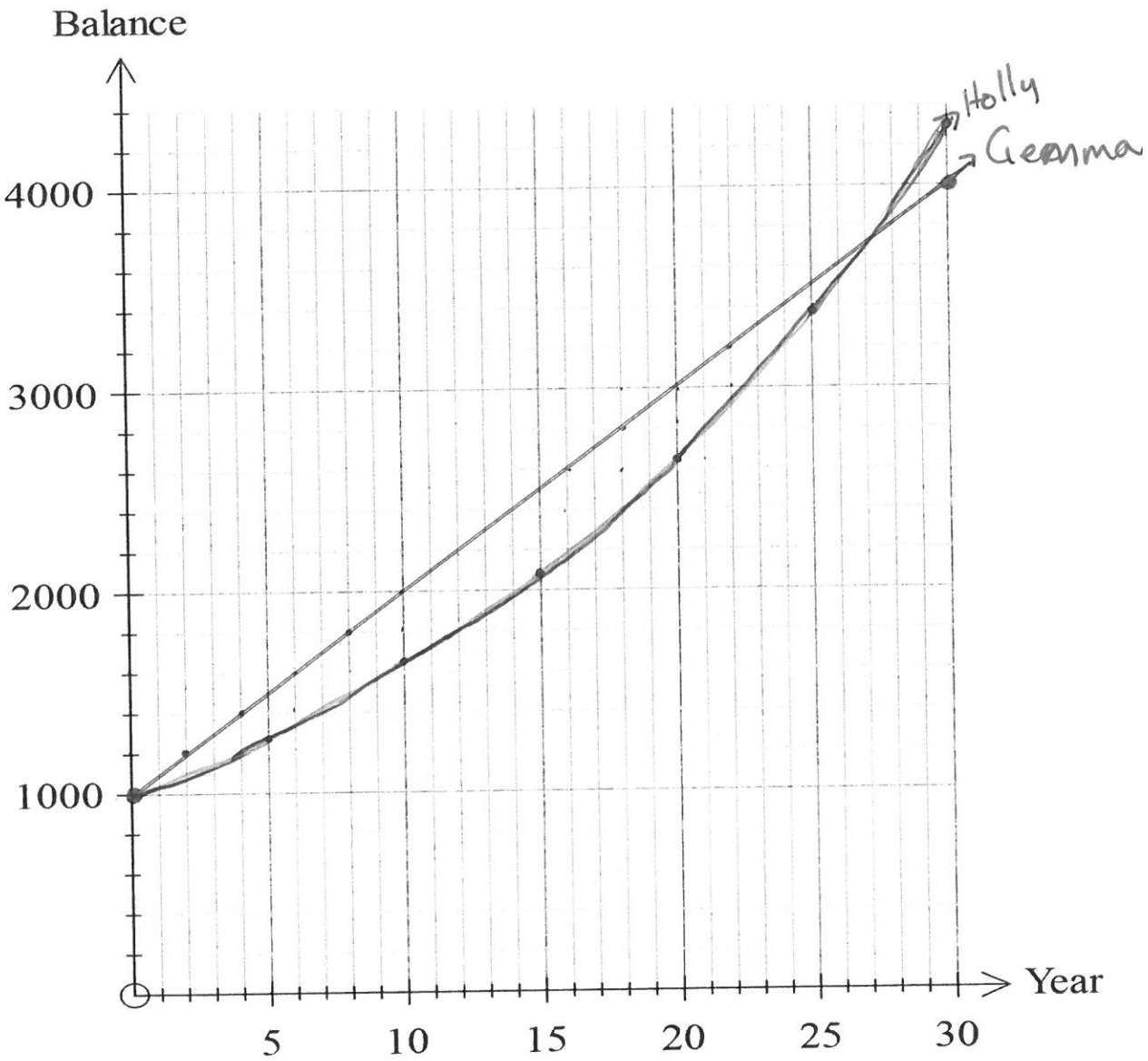
51 years

$1000(1.05)^{51}$

Write an expression to show the balance of Holly's account after n years.

$1000(1.05)^{n}$

Draw a graph of the amount of money in each girl's account over the first 30 years.



What do you notice about each graph?

Gemma's graph

Straight line. $100 added each year

Holly's graph

a curve. getting steeper over time

Predict what will happen to the amounts of money in each account as time goes on.
Gemma's account:

Continue to grow steadily of +100 each year

Holly's account:

Grows exponentially + more and more each year

Looking at the graph, explain which account would be best if the money was withdrawn:
After 10 years

Gemma, has more money

After 20 years

Gemma has more money

After 30 years

Holly, has more money

After 40 years

Holly grows exponentially

After 50 years

Holly grows exponentially

Looking at the graph, during which year will Gemma and Holly have the same amount of money in their accounts?

27th

Situation 2

Mrs Mathematica had two children, Alpha and Beta. She opened up a bank account for each child. Alpha, being the older child, had an account opened with $6 000. The balance of Alpha's account at the end of each of the first 10 years is shown in the table below. Beta's account was opened with only $3 000, her account earned interest of 8% pa compounded at the end of each year.

Year	Alpha's Account	Beta's Account
0	$6 000.00	$3 000.00
1	$6 240.00	3240
2	$6 489.60	3499.20
3	$6 749.18	3779.2
4	$7 019.15	4081.47
5	$7 299.92	4407.98
6	$7 591.91	4760.62
7	$7 895.59	5141.47
8	$8 211.41	5552.79
9	$8 539.87	5997.01
10	$8 881.47	6476.77
11	9236.72	6994.92
12	9606.19	7554.51
13	9990.44	8158.87
14	10 390.10	8811.58
15	10 805.70	9516.51
16	11 237.90	10277.80
17	11687.46	11100.10
18	12154.90	11988.10
19	12641.10	12947.10
20	13146.70	13982.90

a) What is the annual rate of interest for Alpha's account?

$\frac{240}{6000} \times 100 = 4\%$

b) Write an expression for the balance of Alpha's account at the end of each year. Use the letter t to represent the time in years.

$6000(1.04)^t$

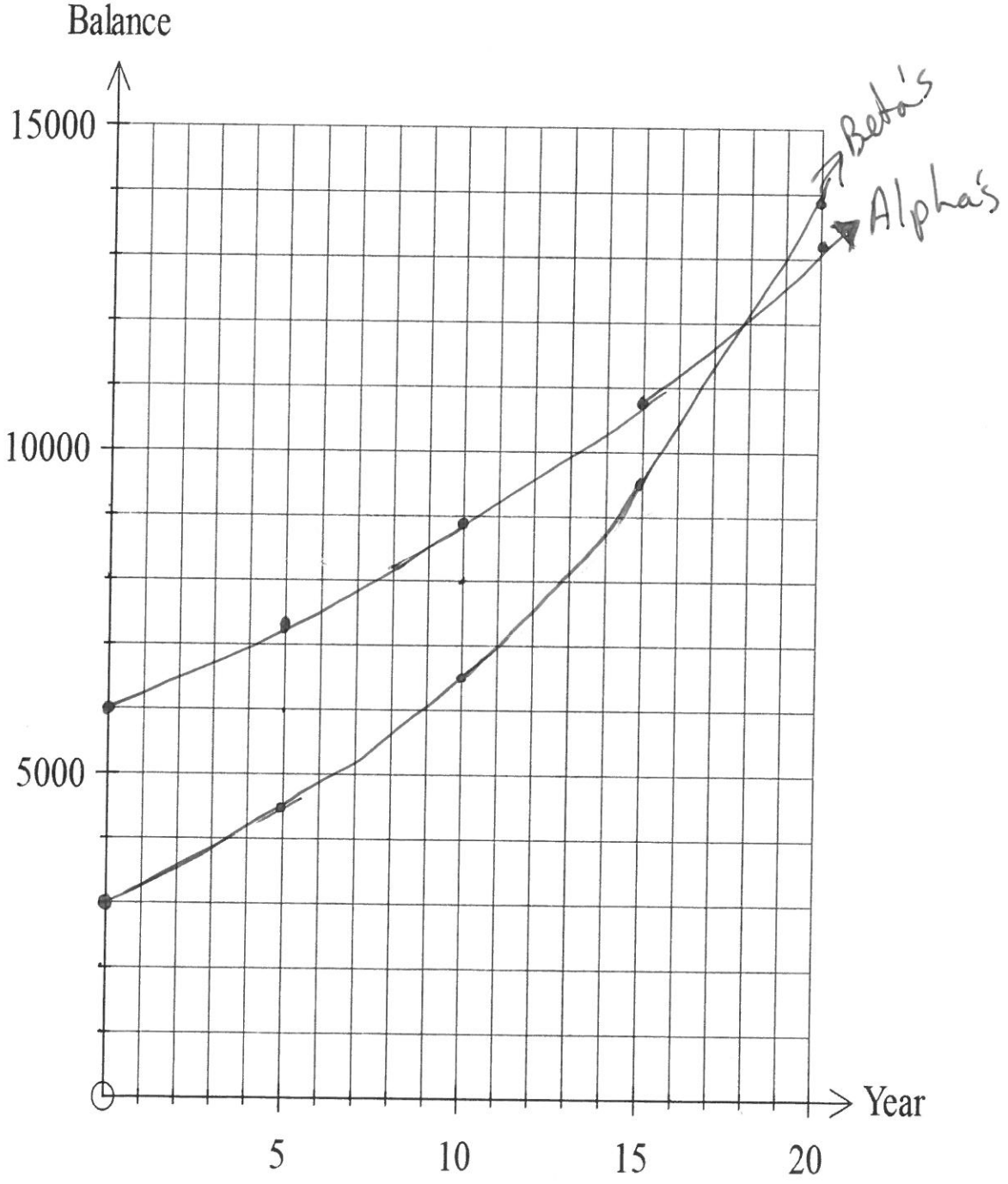
c) Complete the rest of the table showing the amount of money (the balance) of Alpha's account at the end of each year.

d) Write an expression for the balance of Beta's account at the end of each year.
Use t = time.

3000×1.08^t

e) Complete the table showing the balance of Beta's account at the end of each year.

f) Complete the graph below showing the amount of money in each person's account over the first 20 years.



g) Which person has more money after 10 years? Alpha

20 years? Beta

h) Looking at the graphs, during which year will Alpha and Beta have the same amount of money in their accounts?

18th year