

## Challenge: Decimals, Percentages, and Fractions

**Q1.** Write the following decimals as a fraction in simplest form and as a percentage:

(a) 0.125

(b) 0.203125

**Q2.** Convert the following fractions into decimals and percentages:

(a)  $\frac{7}{20}$

(b)  $\frac{33}{320}$

**Q3.** Express the following percentages as decimals and fractions in simplest form:

(a) 17.5%

(b) 57.8125%

**Q4. Basis points** are units used in finance to describe small changes of percentages. A basis point is a percent of a percent:

$$1 \text{ basis point} = 0.01\%$$

They are often used to describe changes in interest rates or yields.

For example, an increase of 25 basis points means the interest rate goes up by 0.25%.

(a) Write one basis point as a decimal and a fraction in simplest form.

(b) Write 175 basis points as a decimal and a fraction in simplest form.

**Gilts** are UK government bonds. When you buy a gilt, you are lending money to the government.

The UK government currently issues 30-year gilts offering a simple return (not compounding) of 5.678% per year.

They use these to borrow money to fund investment. Each year they pay a **coupon** equal to 5.678% of the amount borrowed. At the end of the 30 years they pay back the original amount borrowed.

Other durations (1-year, 5-year, 10-year) of Gilts are also sold.

(c) Find 5.678% as a decimal and a fraction in its simplest form.

(d) Calculate the total cost for the government to borrow £1000 over 30 years, including payback of the original amount.

(e) Suppose the coupon payment of a 30 year gilt rises 43.5 basis points. How much more does it cost the government to borrow £1000 over 30 years?

(f) Gilts offer only simple interest, how might an investor achieve compounding returns, while still only investing in Gilts?

**Q5.** Below is a table of the yields for gilts ranging from 1-5 year maturity durations:

<b>Maturity</b>	<b>Yield (%)</b>
1 Year	4.377
2 Year	4.474
3 Year	4.488
4 Year	4.492
5 Year	4.544

- (a) What do you notice about the yield as the maturity duration increases?
- (b) Assume that yields do not change over time. Which gilt would you recommend to someone looking to get the best return over a 5 year period?
- (c) Consider your answer to Q4(f). What strategy would you use to achieve compounding returns over a 5 year period?
- (d) Implement your strategy, assuming you have £10,000 to invest, at the end of 5 years any gilts you have bought must have reached maturity.  
Clearly indicate which gilts you would buy at the start of the first year, the start of the second, etc. You may not need all the entries in the table  
Round all coupon payments down to the nearest pence.  
A spare table has been provided.

<b>Year 0</b>				
Account cash at start of year	£10,000			
Gilts bought at start of year	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
Total coupon payments at end of year	£			
<b>Year 1</b>				
Gilts bought at start of year	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
All gilts held at start of year	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
Total coupon payments at end of year	£			
<b>Year 2</b>				
Gilts bought at start of year	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
All gilts held at start of year	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
Total coupon payments at end of year	£			
<b>Year 3</b>				
Gilts bought at start of year	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
All gilts held at start of year	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
Total coupon payments at end of year	£			
<b>Year 4</b>				
Gilts bought at start of year	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
All gilts held at start of year	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
Total coupon payments at end of year	£			

<b>Year 0</b>				
Account cash at start of year	£10,000			
Gilts bought at start of year	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
Total coupon payments at end of year	£			
<b>Year 1</b>				
Gilts bought at start of year	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
All gilts held at start of year	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
Total coupon payments at end of year	£			
<b>Year 2</b>				
Gilts bought at start of year	Duration:	Matures end of year:	Yield:	Amount £:
	Duration:	Matures end of year:	Yield:	Amount £:
All gilts held at start of year	Duration:	Matures end of year:	Yield:	Amount £:
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Total coupon payments at end of year	£			
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Total coupon payments at end of year	£			
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	Duration:	Matures end of year:	Yield:	Amount £:
Total coupon payments at end of year	£			

- (e) What is the total value of the investments at the end of the 5th year?
- (f) What annual simple interest rate of return does this correspond to?
- (g) Find the annual interest rate that a savings account would need to pay, assuming interest compounds, to achieve the same returns at the end of a 5 year period?
- (h) What about an account that pays interest at the end of each month - What percentage return would be required at the end of each month?