

2 Percentages

2A Basic percentages

2A.1 HKCEE MA 1989 – I – 1

(Also as 8A.4.)

- The monthly income of a man is increased from \$8000 to \$9000. Find the percentage increase.
- After the increase, the ratio of his savings to his expenditure is 3 : 7 for each month. How much does he save each month?

2A.2 HKCEE MA 2002 – I – 6

The radius of a circle is 8 cm. A new circle is formed by increasing the radius by 10%.

- Find the area of the new circle in terms of π .
- Find the percentage increase in the area of the circle.

2A.3 HKCEE MA 2006 – I – 6

The weight of Tom is 20% more than that of John. It is given that Tom weighs 60 kg.

- Find the weight of John.
- The weight of Susan is 20% less than that of Tom. Are Susan and John of the same weight? Explain your answer.

2A.4 HKCEE MA 2008 – I – 8

There are 625 boys in a school and the number of girls is 28% less than that of boys.

- Find the number of girls in the school.
- There are 860 local students in the school.
 - Find the percentage of local students in the school.
 - It is given that 80% of the boys are local students. If $x\%$ of the girls are also local students, write down the value of x .

2A.5 HKCEE MA 2009 – I – 7

In a survey, there are 172 male interviewees. The number of female interviewees is 75% less than that of male interviewees. Find

- the number of female interviewees,
- the percentage of female interviewees in the survey.

2A.6 HKCEE MA 2010 – I – 7

Mary has 50 badges. The number of badges owned by Tom is 30% less than that owned by Mary.

- How many badges does Tom have?
- If Mary gives a certain number of her badges to Tom, will they have the same number of badges? Explain your answer.

2. PERCENTAGES

2A.7 HKDSE MA 2012 – I – 4

The daily wage of Ada is 20% higher than that of Billy while the daily wage of Billy is 20% lower than that of Christine. It is given that the daily wage of Billy is \$480.

- Find the daily wage of Ada.
- Who has the highest daily wage? Explain your answer.

2A.8 HKDSE MA 2016 – I – 5

In a recreation club, there are 180 members and the number of male members is 40% more than the number of female members. Find the difference of the number of male members and the number of female members.

2A.9 HKDSE MA 2020 – I –

In a recruitment exercise, the number of male applicants is 28% more than the number of female applicants. The difference of the number of male applicants and the number of female applicants is 91. Find the number of male applicants in the recruitment exercise. (4 marks)

2B Discount, profit and loss

2B.1 HKCEE MA 1990 – I – 1

A person bought 10 gold coins at \$3000 each and later sold them all at \$2700 each.

- Find the total loss.
- Find the percentage loss.

2B.2 HKCEE MA 1994 – I – 6

A merchant bought an article for \$ x . He put it in his shop for sale at a marked price 70% higher than its cost. The article was then sold to a customer at a discount of 5%.

- What was the percentage gain for the merchant by selling the article?
- If the customer paid \$2907 for the article, find the value of x .

2B.3 HKCEE MA 1995 – I – 4

Mr. Cheung bought a flat in 1993 for \$2400000. He made a profit of 30% when he sold the flat to Mr. Lee in 1994.

- Find the price of the flat that Mr. Lee paid.
- Mr. Lee then sold the flat in 1995 for \$3000000. Find his percentage gain or loss.

2B.4 HKCEE MA 1998 – I – 7

The marked price of a toy car is \$29. It is sold at a discount of 20%.

- Find the selling price of the toy car.
- If the cost of the toy car is \$18, find the percentage profit.

2B.5 HKCEE MA 2001 – I – 8

The price of a textbook was \$80 last year. The price is increased by 20% this year.

- Find the new price.
- Peter is given a 20% discount when buying the textbook from a bookstore this year. How much does he pay for this book?

2B.6 HKCEE MA 2003 – I – 5

A handbag costs \$400. The marked price of the handbag is 20% above the cost. It is sold at a 25% discount on the marked price.

- Find the selling price of the handbag.
- Find the percentage profit or percentage loss.

2B.7 HKCEE MA 2005 – I – 6

The cost of a calculator is \$160. If the calculator is sold at its marked price, then the percentage profit is 25%.

- Find the marked price of the calculator.
- If the calculator is sold at a 10% discount on the marked price, find the percentage profit or percentage loss.

2. PERCENTAGES

2B.8 HKCEE MA 2007 – I – 6

The marked price of a vase is \$400. The vase is sold at a discount of 20% on its marked price.

- Find the selling price of the vase.
- A profit of \$70 is made by selling the vase. Find the percentage profit.

2B.9 HKCEE MA 2011 – I – 7

The marked price of a birthday cake is \$360. The birthday cake is sold at a discount of 45% on its marked price.

- Find the selling price of the birthday cake.
- If the marked price of the birthday cake is 80% above its cost, determine whether there will be a gain or a loss after selling the birthday cake. Explain your answer.

2B.10 HKDSE MA SP – I – 4

The marked price of a handbag is \$560. It is given that the marked price of the handbag is 40% higher than the cost.

- Find the cost of the handbag.
- If the handbag is sold at \$460, find the percentage profit.

2B.11 HKDSE MA PP – I – 4

The cost of a chair is \$360. If the chair is sold at a discount of 20% on its marked price, then the percentage profit is 30%. Find the marked price of the chair.

2B.12 HKDSE MA 2014 – I – 6

The marked price of a toy is \$255. The toy is now sold at a discount of 40% on its marked price.

- Find the selling price of the toy.
- If the percentage profit is 2%, find the cost of the toy.

2B.13 HKDSE MA 2015 – I – 6

The cost of a book is \$250. The book is now sold and the percentage profit is 20%.

- Find the selling price of the book.
- If the book is sold at a discount of 25% on its marked price, find the marked price of the book.

2B.14 HKDSE MA 2018 – I – 7

The marked price of a vase is 30% above its cost. A loss of \$88 is made by selling the vase at a discount of 40% on its marked price. Find the marked price of the vase.

2B.15 HKDSE MA 2019 – I – 5

A wallet is sold at a discount of 25% on its marked price. The selling price of the wallet is \$690.

- Find the marked price of the wallet.
- After selling the wallet, the percentage profit is 15%. Find the cost of the wallet.

2C Interest

2C.1 HKCEE MA 1983(A/B) – I – 6

The compound interest on \$1000 at 10% per annum for 3 years, compounded yearly, equals the simple interest on another \$1000 at $r\%$ per annum for the same period of time. Calculate r to 2 decimal places.

2C.2 HKCEE MA 1991 – I – 3

(Also as 8A.6)

A man buys some British pounds (£) with 150000 Hong Kong dollars (HK\$) at the rate £1 = HK\$15.00 and puts it on fixed deposit for 30 days. The rate of interest is 14.60% per annum.

- How much does he buy in British pounds?
- Find the amount in British pounds at the end of 30 days.
(Suppose 1 year = 365 days and the interest is calculated at simple interest.)
- If he sells the amount in (b) at the rate of £1 = HK\$14.50, how much does he get in Hong Kong dollars?

2C.3 HKCEE MA 1993 – I – 1(a)

What is the simple interest on \$100 for 6 months at 3% p.a.?

2C.4 HKCEE MA 1996 I – 12

Bank A offers personal loans at an interest rate of 18% per annum. For each successive month after the day when the loan is taken, loan interest is calculated and an instalment is paid.

(Answers to this question should be corrected to 2 decimal places.)

- Mr. Chan took a personal loan of \$50000 from Bank A and agreed to repay the bank in monthly instalments of \$9000 until the loan is fully repaid (the last instalment may be less than \$9000). The outstanding balance of his loan for each of the first three months is shown in Table 1.
 - Complete Table 1 until the loan is fully repaid.
 - Find the amount of his last instalment.
 - Calculate the total interest earned by the bank.
- Mrs. Lee also took a personal loan of \$50000 from Bank A. She agreed to pay \$9000 as the first monthly instalment and increase the amount of each instalment by 20% for every successive month until the loan is fully repaid. The outstanding balance of her loan for the first month is shown in Table 2. Complete Table 2 until the loan is fully repaid.
- Mr. Cheung wants to buy a \$50 000 piano for her daughter but he has no savings at hand. He intends to buy the piano by taking a personal loan of \$50 000 from Bank A. If he can only save \$12000 from his income every month and uses his savings to repay the loan, can he afford to use the repayment scheme as described in (b)? Explain your answer.

Table 1 The outstanding balance of Mr. Chan's loan for each month

Month	Loan Interest (\$)	Loan Repaid (\$)	Outstanding Balance (\$)
1	750.00	8 250.00	41 750.00
2	626.25	8 373.75	33 376.25
3	500.64	8 499.36	24 876.89
4			
5			
6			

Table 2 The outstanding balance of Mrs. Lee's loan for each month

Month	Instalment (\$)	Loan Interest (\$)	Loan Repaid (\$)	Outstanding Balance (\$)
1	9 000.00	750.00	8 250.00	41 750.00
2				
3				
4				
5				

2. PERCENTAGES

2C.5 HKCEE MA 2000 – I – 10

- Solve $10x^2 + 9x - 22 = 0$.
- Mr. Tung deposited \$10000 in a bank on his 25th birthday and \$9000 on his 26th birthday. The interest was compounded yearly at $r\%$ p.a., and the total amount he received on his 27th birthday was \$22000. Find r .

2C.6 HKCEE MA 2004 – I – 3

A sum of \$5000 is deposited at 2% p.a. for 3 years, compounded yearly. Find the interest correct to the nearest dollar.

2 Percentages

2A Basic percentages

2A.1 HKCEE MA 1989-I-1

(a) % increase = $\frac{9000 - 8000}{8000} \times 100\% = 12.5\%$

(b) Amount saved = $\$9000 \times \frac{3}{3+7} = \2700

2A.2 HKCEE MA 2002-I-6

(a) New radius = $8 \times (1 + 10\%) = 8.8$ (cm)
 \Rightarrow New area = $\pi(8.8)^2 = 77.44\pi$ (cm²)

(b) % increase = $\frac{77.44\pi - \pi(8)^2}{\pi(8)^2} \times 100\% = 21\%$

2A.3 HKCEE MA 2006-I-6

(a) Weight of John = $60 \div (1 + 20\%) = 50$ (kg)

(b) Weight of Susan = $60 \times (1 - 20\%) = 48 \neq 50$ (kg)
 No.

2A.4 HKCEE MA 2008-I-8

(a) Number of girls = $625 \times (1 - 25\%) = 450$

(b) (i) Required % = $\frac{860}{625 + 450} \times 100\% = 80\%$

(ii) 80

2A.5 HKCEE MA 2009-I-7

(a) Number of female interviewees = $172 \times (1 - 75\%) = 43$

(b) Required % = $\frac{43}{172 + 43} \times 100\% = 20\%$

2A.6 HKCEE MA 2010-I-7

(a) Number of badges Tom has = $50 \times (1 - 30\%) = 35$

(b) Method 1
 Total number of badges = $50 + 35 = 85$, which is odd!
 \therefore No.

Method 2

Let Mary give x badges.

$$50 - x = 35 + x$$

$$x = 7.5, \text{ which is not an integer!}$$

No.

2A.7 HKDSE MA 2012-I-4

(a) Daily wage of Ada = $\$480 \times (1 + 20\%) = \576

(b) Daily wage of Christine = $\$480 \div (1 - 20\%) = \600
 $\therefore 600 > 576 > 480$
 \therefore Christine

2A.8 HKDSE MA 2016-I-5

Let there be x female members.

Number of male members = $1.4x$

$$\Rightarrow 1.4x + x = 180$$

$$x = 75$$

\therefore There are 75 female and $1.4(75) = 105$ male members.

$$\Rightarrow \text{Difference} = 30$$

2A.9 on the next page

2B Discount, profit and loss

2B.1 HKCEE MA 1990-I-1

(a) Total loss = $\$(3000 - 2700) \times 10 = \3000

(b) % loss = $\frac{3000}{3000 \times 10} \times 100\% = 10\%$

2B.2 HKCEE MA 1994-I-6

(a) Marked price = $\$1.7x$

Selling price = $\$1.7x(1 - 5\%) = \$1.615x$

$$\therefore \% \text{ gain} = \frac{1.615x - x}{x} \times 100\% = 61.5\%$$

(b) $1.615x = 2907 \Rightarrow x = 1800$

2B.3 HKCEE MA 1995-I-4

(a) Price = $\$2400000 \times (1 + 30\%) = \3120000

(b) % loss = $\frac{3120000 - 3000000}{3120000} \times 100\% = 3.85\%$

2B.4 HKCEE MA 1998-I-7

(a) Selling price = $\$29 \times (1 - 20\%) = \23.2

(b) % profit = $\frac{23.2 - 18}{18} \times 100\% = 28.9\%$

2B.5 HKCEE MA 2001-I-8

(a) New price = $\$80 \times (1 + 20\%) = \96

(b) Amount he pays = $\$96 \times (1 - 20\%) = \76.8

2B.6 HKCEE MA 2003-I-5

(a) Marked price = $\$400 \times (1 + 20\%) = \480

\Rightarrow Selling price = $\$480 \times (1 - 25\%) = \360

(b) % loss = $\frac{400 - 360}{400} \times 100\% = 10\%$

2B.7 HKCEE MA 2005-I-6

(a) Marked price = $\$160 \times (1 + 25\%) = \200

(b) Selling price = $\$200 \times (1 - 10\%) = \180

$$\therefore \% \text{ profit} = \frac{180 - 160}{160} \times 100\% = 12.5\%$$

2B.8 HKCEE MA 2007-I-6

(a) Selling price = $\$400 \times (1 - 20\%) = \320

(b) % profit = $\frac{70}{320 - 70} \times 100\% = 28\%$

2B.9 HKCEE MA 2011-I-7

(a) Selling price = $\$360 \times (1 - 45\%) = \198

(b) Cost = $\$360 \div (1 + 80\%) = \$200 > \$198$
 \therefore Loss

2B.10 HKDSE MA SP-I-4

(a) Cost = $\$560 \div (1 + 40\%) = \400

(b) % profit = $\frac{460 - 400}{400} \times 100\% = 15\%$

2B.11 HKDSE MA PP-I-4

Selling price = $\$360 \times (1 + 30\%) = \468

\Rightarrow Marked price = $\$468 \div (1 - 20\%) = \585

2B.12 HKDSE MA 2014-I-6

- (a) Selling price = $\$255 \times (1 - 40\%) = \153
 (b) Cost = $\$153 \div (1 + 2\%) = \150

2B.13 HKDSE MA 2015-I-6

- (a) Selling price = $\$250 \times (1 + 20\%) = \300
 (b) Marked price = $\$300 \div (1 - 25\%) = \400

2B.14 HKDSE MA 2018-I-7

Let the marked price be $\$x$. Then
 Cost = $\$x \div (1 + 30\%) = \frac{10}{13}x$
 Selling price = $\$x \times (1 - 40\%) = \$0.6x$
 $0.6x + 88 = \frac{10}{13}x \Rightarrow x = 520$
 \therefore The marked price is $\$520$.

2B.15 HKDSE MA 2019-I-5

- (a) Marked price = $\$690 \div (1 - 25\%) = \920
 (b) Cost = $\$690 \div (1 + 15\%) = \600

****2A.9 HKDSE MA 2020-I-5**

Let x be the number of female applicants.
 Then, the number of male applicants is $x(1 + 28\%) = 1.28x$.
 $1.28x - x = 91$
 $x = 325$
 The number of male applicants = 1.28×325
 $= 416$

2C Interest

2C.1 HKCEE MA 1983(A/B)-I-6

$$1000(1 + 10\%)^3 - 1000 = 1000 \times r\% \times 3$$

$$331 = 30r$$

$$r = 11.03 \quad (2 \text{ d.p.})$$

2C.2 HKCEE MA 1991-I-3

- (a) $\pounds 150000 \div 15 = \pounds 10000$
 (b) Amount = $10000 + 10000 \times 14.60\% \times \frac{30}{365}$
 $= (\pounds) 10120$
 (c) $\$10120 \times 14.50 = \146740

2C.3 HKCEE MA 1993-I-1(a)

$$\text{Interest} = \$100 \times 3\% \times \frac{6}{12} = \$1.5$$

2C.4 HKCEE MA 1996-I-12

- (a) (i) **Table 1**
- | | | | |
|---|--------|---------|----------|
| 4 | 373.15 | 8626.85 | 16250.04 |
| 5 | 243.75 | 8756.25 | 7493.79 |
| 6 | 112.41 | 7493.79 | 0 |
- (ii) Amount = $112.41 + 7493.79 = (\$)7606.20$
 (iii) Total interest
 $1750.00 + 626.25 + 500.64 + 373.15$
 $+ 243.75 + 112.41$
 $= (\$)2606.20$

(b) **Table 2**

2	10800.00	626.25	10173.75	31576.25
3	12960.00	473.64	12486.36	19089.89
4	15552.00	286.35	15265.65	3824.24
5	3881.60	57.36	3824.24	0

- (c)
- | Month | Savings (\$) | Instalment (\$) | Remaining (\$) |
|-------|--------------|-----------------|----------------|
| 1 | 12000 | 9000 | 3000 |
| 2 | 15000 | 10800 | 4200 |
| 3 | 16200 | 12960 | 3240 |
| 4 | 15240 | 15552 | |
- Since the savings ($\$15240$) would not be enough for another instalment ($\$15552$), he cannot.

2C.5 HKCEE MA 2000-I-10

- (a) $x = 1.1$ or -2
 (b) $10000(1 + r\%)^2 + 9000(1 + r\%) = 22000$
 $10(1 + r\%)^2 + 9(1 + r\%) - 22 = 0$
 $1 + r\% = 1.1$ or -2 (rejected)
 $r = 10$

2C.6 HKCEE MA 2004-I-3

$$\text{Interest} = \$5000(1 + 2\%)^3 - \$5000$$

$$= \$30.6 \text{ (nearest dollar)}$$