

Exercise walk-through

1.5

Casting and Range of Variables

AP Computer Science A

What we will cover

- 1 Programs & compilers
- 2 Variables & data types
- 3 Expressions & casting
- 4 Methods & the Math class
- 5 Objects & strings

Integer division truncates, and the cast position decides

the trap

`7 / 2` is 3, not 3.5 – two ints divide to an int

the fix

cast **one operand** first: `(double) 7 / 2` is 3.5

the wrong fix

`(double) (7 / 2)` is 3.0 – the truncation already happened inside the brackets

so

the **position of the cast** decides whether the truncation happens at all

escape sequence

`\n` and `\t` inside a String – a backslash changes what the next character means

Watch for integer division producing a truncated result where a decimal was wanted. It compiles, it runs, and it is silently wrong – a **logic error**.

Class methods, instance methods, and where code comes from

class (static) method

belongs to the [class itself](#), so you call it on the class name:
`Math.abs(x)`. [No object needed](#)

instance method

belongs to an [object](#), so you call it on a reference: `s.length()`

a library

pre-written classes you can use; Java's is the [API](#)

compiled

Java source is compiled once to bytecode, then run – so syntax errors surface [before](#) the program starts

abstraction

using a method by its name and contract, without knowing how it works inside

If you find yourself creating an object just to call a method on it, check whether the method is `static` – `Math.sqrt` on a new `Math()` does not compile.

Exercises 2.1-2.2

2.1 Evaluate: (i) `(int) 9.99`; (ii) `(int) -2.5`; (iii) `(double) 9 / 4`; (iv) `(double) (9 / 4)`. [4]

2.2 Write an expression that rounds the positive `double price` to the nearest whole number of dollars. [1]

Exercises 2.1-2.2

2.1 Evaluate: (i) `(int) 9.99`; (ii) `(int) -2.5`; (iii) `(double) 9 / 4`; (iv) `(double) (9 / 4)`. [4]

2.1

- (i) **9**
- (ii) **-2**
- (iii) **2.25**
- (iv) **2.0**

2.2 Write an expression that rounds the positive `double price` to the nearest whole number of dollars. [1]

2.2

- `(int) (price + 0.5)`

Exercises 2.3-3.1

2.3 Explain why `int big = Integer.MAX_VALUE; big++;` makes `big` negative. [2]

3.1 Which expression gives the average of `int a = 7` and `int b = 8` as 7.5? [1]

☐

A `(a + b) / 2`

B `(double) ((a + b) / 2)`

C `(a + b) / 2.0`

D `(int) ((a + b) / 2.0)`

Exercises 2.3-3.1

2.3 Explain why `int big = Integer.MAX_VALUE; big++;` makes `big` negative. [2]

2.3

- `big` is the largest `int`; adding 1 goes past the top of the range
- it overflows and wraps round to `Integer.MIN_VALUE`

3.1 Which expression gives the average of `int a = 7` and `int b = 8` as 7.5? [1]

☐

A `(a + b) / 2`

B `(double) ((a + b) / 2)`

C `(a + b) / 2.0`

D `(int) ((a + b) / 2.0)`

3.1 C

- `2.0` makes the division a `double` division

Exercises 3.2-3.3

3.2 What is the value of `(int) (2.6 * 3)`?

[1]

☐

A 6

B 7

C 7.8

D 8

3.3 Which statement does **not** compile?

[1]

☐

A `double d = 4;`

B `int n = (int) 4.7;`

C `int n = 4.7;`

D `double d = (double) 4 / 3;`

Exercises 3.2-3.3

3.2 What is the value of `(int) (2.6 * 3)`?

[1]

☐

A 6

B 7

C 7.8

D 8

3.2 B

- $2.6 \times 3 = 7.8$, truncated to 7

3.3 Which statement does **not** compile?

[1]

☐

A `double d = 4;`

B `int n = (int) 4.7;`

C `int n = 4.7;`

D `double d = (double) 4 / 3;`

3.3 C

- a `double` cannot be stored in an `int` without a cast

Exercise 3.4 (a)

3.4 A quiz gives each student a mark out of 40. The program converts it to a whole-number percentage.

(a) A student writes `int pct = mark / 40 * 100;`. State the result for a mark of 30, and explain why. [2]

Exercise 3.4 (a)

3.4 A quiz gives each student a mark out of 40. The program converts it to a whole-number percentage.

(a) A student writes `int pct = mark / 40 * 100;`. State the result for a mark of 30, and explain why. [2]

(a)

- **0**
- `30 / 40` is integer division, giving 0, and $0 \times 100 = 0$

Exercise 3.4 (b)

3.4 A quiz gives each student a mark out of 40. The program converts it to a whole-number percentage.

(b) Write a statement that sets `pct` to the percentage **rounded** to the nearest whole number.

[2]

Exercise 3.4 (b)

3.4 A quiz gives each student a mark out of 40. The program converts it to a whole-number percentage.

(b) Write a statement that sets `pct` to the percentage **rounded** to the nearest whole number. [2]

(b)

- `int pct = (int) (mark / 40.0 * 100 + 0.5);`

Exercise 3.4 (c)

3.4 A quiz gives each student a mark out of 40. The program converts it to a whole-number percentage.

(c) State `pct` from your statement for marks of 30 and 33.

[2]

Exercise 3.4 (c)

3.4 A quiz gives each student a mark out of 40. The program converts it to a whole-number percentage.

(c) State `pct` from your statement for marks of 30 and 33. [2]

(c)

- 30: $75.0 + 0.5 \rightarrow \mathbf{75}$
- 33: $82.5 + 0.5 = 83.0 \rightarrow \mathbf{83}$