

It is generally true that operations on values of the same type produce results of that type. In particular, if we divide two integers, the result is the integral quotient with any remainder being ignored. The values of the divisor or dividend may be either positive or negative. The sign of the quotient follows the usual rules of division.

Example 2

- | | |
|------------------------------|-----------------------------------|
| (a) $15/3 \Rightarrow 5$ | (b) $13/4 \Rightarrow 3$ |
| (c) $9/5 \Rightarrow 1$ | (d) $7/9 \Rightarrow 0$ |
| (e) $27L/10L \Rightarrow 2L$ | (f) $9999L/10000L \Rightarrow 0L$ |
| (g) $7/(-3) \Rightarrow -2$ | (h) $-15/4 \Rightarrow -3$ |
| (i) $-5/(-6) \Rightarrow 0$ | (j) $(-9)/(-5) \Rightarrow 1$ |

Whenever integer and floating point values are mixed in an expression, the floating point values are contagious so that the result is always a floating point value. In addition, if different integer types are mixed, the result is that of the widest type. The same is true if floating point types are mixed: the result of combining float and double values is always double.

Example 3

- | | |
|----------------------------------|-------------------------|
| (a) $5 + 2.0 \Rightarrow 7.0$ | The result is a double. |
| (b) $3 * 4L \Rightarrow 12L$ | The result is a long. |
| (c) $2.5f + 2.5 \Rightarrow 5.0$ | The result is a double. |

Exercises 2.1

1. Evaluate each valid expression and state the type of the result. If the expression is invalid, give the reason. Use a decimal point in your answer if the result is a floating point value (either float or double). For example, use 3.0 rather than 3 to write a floating point result whose value is three.

- | | |
|-------------------------|-------------------------|
| (a) $2 + 7 / 2$ | (b) $5(6 + 3.0)$ |
| (c) $2e02 - 02$ | (d) $3 * 5 / 2$ |
| (e) $3.0 * 5 / 2$ | (f) $2 * (3 / 4L)$ |
| (g) $2.0 + 7 / (3 / 4)$ | (h) $3f * 4 / 5$ |
| (i) $35 / (5 / 4)$ | (j) $4 - [6 - (2 - 7)]$ |
| (k) $3 / 4 * 2.0$ | (l) $3 / (4 * 2.0)$ |

2. Evaluate.

- | | |
|------------------------|-------------------------|
| (a) $17 \% 5$ | (b) $23 \% 10$ |
| (c) $20 / 3 + 20 \% 3$ | (d) $-10 \% 2 + 1 / 2$ |
| (e) $-7\%(-2)/5$ | (f) $2.7\%4$ |
| (g) $7 \% 1.5$ | (h) $2L + 5.7f \% 1.2f$ |
| (i) $1.5 \% (3/4)$ | (j) $2 - 5/0.0$ |
| (k) $(-7)\%(-3)$ | (l) $(-5)\%(-1.5)$ |

3. Delete any unnecessary parentheses.

- (a) $((a * b) / (c + d))$
- (b) $((a * b) - (c \% d))$
- (c) $((a - b) \% c) / (d * (e + f))$
- (d) $((a * b) - (c / d) - (e / (f / g)))$

4. Write as Java expressions.

- (a) $\frac{x}{2} + 4(y - 3)$
- (b) $x^3 + y^3$
- (c) $2\frac{x+1}{y-2}$
- (d) $\frac{\frac{x}{y} + z}{x + \frac{y}{z}}$

5. Use the symbols +, -, *, /, %, (, and) as often as you wish, together with the numerals 1, 8, 6, and 7, each used once, in the given order, to create Java expressions whose values are 0, 1, ..., 10.

As an example, to obtain the value zero, we could write

$$1 / 8 + 6 / 7 \Rightarrow 0 + 0 \Rightarrow 0$$

Exercises 2.2

1. Find the value of each expression. Use a decimal point in your answer if the result is a floating point value.

- (a) `(int) 1.8 * 0.6`
- (b) `(int)(2/0.9)`
- (c) `6 / 5 % (double) 2`
- (d) `2*(double)(7/4)`
- (e) `(int)6.3 - (int)4.7`
- (f) `(int)6.3 - 4.7`
- (g) `(int)(6.3 - 4.7)`
- (h) `(double) 3 * 5 / 0`
- (i) `(float)2*3 + 0.1`
- (j) `(double) (7 % 4 / 3)`

2. Assume that a program contains the following declarations.

```
int i = 5, j = 2;
```

What will be printed by each statement?

- (a) `System.out.println(i + j + 2);`
- (b) `System.out.println(i + " " + j + 2);`
- (c) `System.out.println(i * j + 2);`
- (d) `System.out.println("i * j " + 2);`

3. Assume that a program contains the following declarations.

```
int i = 4, j = 7;
```

What will be printed by each statement?

- (a) `System.out.println("i " + i);`
- (b) `System.out.println(i + j);`
- (c) `System.out.println("i + j -> " + i + j);`
- (d) `System.out.println(i + j + " <- i + j");`
- (e) `System.out.println("i * j -> " + i * j);`

Exercises 2.6

1. State the value and type of each expression.

(a) `Math.abs(-5)-Math.abs(-7)`

(b) `Math.abs(-1e-1)+Math.abs(-2e-2)`

(c) `Math.sqrt(0.0064)`

(d) `Math.sqrt(Math.pow(2.7,2))`

(e) `Math.round(3.499)`

(f) `Math.max(1.5e-2,0.095)`

(g) `Math.ceil(4.002)`

(h) `Math.min(-5,1.0)`

(i) `Math.floor(7.99)`

(j) `Math.ceil(-2.73)`

(k) `Math.pow(16,0.25)`

(l) `Math.pow(4,-2)`

(m) `Math.round(1.49 + 0.1)`

(n) `Math.round(1.49) + 0.1`

2. Write as Java expressions.

(a) $\sqrt{a^2 - b^2}$

(b) $\pi(x^6 - y^6)$

(c) $\frac{4}{3}\pi r^3$

(d) $|z^4 - 1|$

(e) $\ln|1+x|$

(f) $x^2 e^x$

read booklet page 33 to understand #3-6

3. A student incorrectly attempted to produce a random value uniformly distributed over the set $\{1, 2, \dots, 6\}$ using the expression

`6*(int)Math.random() + 1`

State and explain the actual value of the expression.

4. Write a statement that will make the `int` variable `result` take on a random value uniformly distributed over the given set.

(a) $\{1, 2, 3, \dots, 10\}$

(b) $\{1, 2, 3, \dots, 52\}$

(c) $\{5, 10, 15, \dots, 100\}$

(d) $\{-5, -4, -3, \dots, 5\}$

(e) $\{100, 110, 120, \dots, 300\}$

(f) $\{a, a+b, a+2b, \dots, a+kb\}$ where a , b , and k are integers.

5. Write a statement that will assign the `char` variable `randChoice` a random value from the set $\{'A', 'B', 'C', 'D', 'E'\}$.

6. Write a statement that will assign the `double` variable `randVal` a random value from the set $\{1.00, 1.25, 1.50, \dots, 4.00\}$.

Exercises 2.7

1. Evaluate.

- (a) $6 / 4 * 2$
- (b) $2 * 3 / 2$
- (c) $(\text{int})2.7 * 1.8$
- (d) $(\text{int})2.7 * (\text{int})1.8$
- (e) $(\text{int})(2.7 * 1.8)$

2. Evaluate. Use a decimal point in your answer if the result is double.

- (a) $15 / 6 + 15 \% 6$
- (b) $3e-1 + 2e1$
- (c) $2 / 5 * 8.0$
- (d) $1.6 * 20 \% 8$
- (e) $(\text{double})(25/4)$
- (f) $(\text{int}) 2.7 + 6.3$
- (g) $20 - 10 * (15\%4)$
- (h) $7 / (-5) + 4\%(-3)$
- (i) $2 * 3 / (\text{double})4$
- (j) $(\text{int}) 4.8 \% 1.1$

3. Each of the following expressions is intended to evaluate the expression

$$\frac{ax^2 + b}{cx + d}$$

Some are correct while others are not. Classify each as being correct or incorrect. For those that are incorrect, give the reason(s).

- (a) $(a * x * x + b) / ((c * x + d)$
- (b) $(a * \text{Math.pow}(x, 2) + b) / (c * x + d)$
- (c) $((a)(x)(x) + (b)) / ((c)(x) + d)$
- (d) $(b + x * (x * (a))) / (d + x * (c))$
- (e) $(a) * \text{Math.pow}(x, 2) + (b) / ((c) * (x) + d)$
- (f) $(a * (x * x)) + (b) / c * (x) + d$

4. Evaluate.

- (a) $\text{Math.round}(\text{Math.sqrt}(20))$
- (b) $\text{Math.ceil}(-4.6)$
- (c) $\text{Math.min}(0.0024, 1.2e-3)$
- (d) $\text{Math.pow}(0.5, -4)$

5. Write as Java expressions.

- (a) $\sqrt{\pi|a^2 - b^2|}$
- (b) $\sqrt[4]{x^6 + y^6}$
- (c) $\frac{-b + \sqrt{b^2 - 4ac}}{2a}$
- (d) $\frac{1}{a^{-1} + b^{-1}}$

6. Write as Java statements.

- (a) $y = \frac{1}{\sin^2 x - \cos^2 x}$
- (b) $s = \sqrt{1 + \tan^2 x}$