Year 9 Mathematics
Class Quiz 1
Topics 1, 2, 3, 4

PEN Education

2023

Contents

1 Introduction

Today we are going to spend an hour doing an in-class quiz! Everyone knows how much you *despise* such **tests**, but according to the literature, testing yourself is the most effective way to learn!
You should realise that over the past 4 weeks you have covered the following topics: 1 - Algebra techniques, 2 - Pythagoras' Theorem and Surds, 3 - Consumer Arithmetic and most recently: 4 - Factorisation.
The following quiz is deliberately CHUNKING these topics together to make it **easy** for you. You also must understand that in a school exam all of these questions will be mixed together! As such, your brain is going to have a difficult time changing gears between the different types of problems. So, we have planned half-yearly and yearly exams containing mixed questions for you. Yay!

2 Algebra

1. Evaluate $3x + 2y^2$ when: [4]

(a) $x = 2$ and $y = 3$

Solution: $3(2) + 2(3)^2 = 6 + 2(9) = 6 + 18 = 24$

(b) $x = 5$ and $y = 2$

Solution: $3(5) + 2(2)^2 = 15 + 2(4) = 15 + 8 = 23$

(c) $x = -23$ and $y = -3$

Solution: $3(-23) + 2(-3)^2 = -69 + 2(9) = -69 + 18 = -51$

(d) $x = \frac{1}{2}$ and $y = \frac{-3}{5}$

Solution: $3\left(\frac{1}{2}\right) + 2\left(\frac{-3}{5}\right)^2 = \frac{3}{2} + 2\left(\frac{9}{25}\right) = \frac{3}{2} + \frac{18}{25} = \frac{75}{50} + \frac{36}{50} = \frac{111}{50}$

2. Simply each of these expressions by collecting like terms. [4]

(a) $3a + 2b - a + 4b$

Solution: $3a - a + 2b + 4b = 2a + 6b$

(b) $5x^2y - 3xy + 7xy - x^2y$

Solution: $5x^2y - x^2y - 3xy + 7xy = 4x^2y + 4xy$

(c) $7m + 12n^2 + 2n^2 - 9m$

Solution: $7m - 9m + 12n^2 + 2n^2 = -2m + 14n^2$

(d) $p^2 - 6p - p + 15$

Solution: $p^2 - 6p - p + 15 = p^2 - 7p + 15$

3. Simplify: [4]

(a) $7ab \times 2a$

Solution: $7ab \times 2a = 14a^2b$

(b) $-3x \times -2y$

Solution: $-3x \times -2y = 6xy$

(c) $\frac{20xy}{5x}$

Solution: $\frac{20xy}{5x} = 4y$

(d) $25a \div 5 \times 3$

Solution: $25a \div 5 \times 3 = 5a \times 3 = 15a$

4. Write each expression as a single fraction. [6]

(a) $\frac{a}{5} - \frac{2a}{3}$

Solution: $\frac{a}{5} - \frac{2a}{3} = \frac{3a-10a}{15} = \frac{-7a}{15}$

(b) $\frac{3x}{8} - \frac{2x}{5}$

Solution: $\frac{3x}{8} - \frac{2x}{5} = \frac{15x-16x}{40} = \frac{-x}{40}$

(c) $\frac{a}{5} \times \frac{2a}{3}$

Solution: $\frac{a}{5} \times \frac{2a}{3} = \frac{2a^2}{15}$

(d) $\frac{a}{2b} \times \frac{2ab}{7}$

Solution: $\frac{a}{2b} \times \frac{2ab}{7} = \frac{a^2}{7}$

(e) $\frac{3x}{4} \div \frac{6x}{7}$

Solution: $\frac{3x}{4} \div \frac{6x}{7} = \frac{3x}{4} \times \frac{7}{6x} = \frac{7}{8}$

(f) $\frac{ab}{3} \div \frac{6b}{b}$

Solution: $\frac{ab}{3} \div \frac{6b}{b} = \frac{ab}{3} \times \frac{b}{6b} = \frac{a}{18}$

5. Expand: 6

(a) $3(a+4)$

Solution: $3(a+4) = 3a + 12$

(b) $6(x-1)$

Solution: $6(x-1) = 6x - 6$

(c) $2(3b+2)$

Solution: $2(3b+2) = 6b + 4$

(d) $5(4d-1)$

Solution: $5(4d-1) = 20d - 5$

(e) $-3(3d-2)$

Solution: $-3(3d-2) = -9d + 6$

(f) $-2(5\ell-4)$

Solution: $-2(5\ell-4) = -10\ell + 8$

(g) $-2x(3x+1)$

Solution: $-2x(3x+1) = -6x^2 - 2x$

(h) $4x(2x+3)$

Solution: $4x(2x+3) = 8x^2 + 12x$

6. Expand and collect like terms for each of these expressions. 6

(a) $3(a+2)+4(a+5)$

Solution: $3(a+2)+4(a+5) = 3a+6+4a+20 = 7a+26$

(b) $4(2x-1)+3(3x+2)$

Solution: $4(2x-1)+3(3x+2) = 8x-4+9x+6 = 17x+2$

(c) $5(3d-2)+4(2d-7)$

Solution: $5(3d-2)+4(2d-7) = 15d-10+8d-28 = 23d-38$

(d) $8(4e+3)-5(e-1)$

Solution: $8(4e+3)-5(e-1) = 32e+24-5e+5 = 27e+29$

(e) $6(f-2)-3(2f-5)$

Solution: $6(f-2)-3(2f-5) = 6f-12-6f+15 = 3$

(f) $2x(x+4)+3(x-2)$

Solution: $2x(x+4)+3(x-2) = 2x^2+8x+3x-6 = 2x^2+11x-6$

(g) $x(3x+2)-4x(2x-3)$

Solution: $x(3x+2)-4x(2x-3) = 3x^2+2x-8x^2+12x = -5x^2+14x$

7. Simplify: 4

(a) $\frac{x+1}{4}+\frac{x+3}{3}$

Solution: $\frac{x+1}{4}+\frac{x+3}{3} = \frac{3(x+1)+4(x+3)}{12} = \frac{3x+3+4x+12}{12} = \frac{7x+15}{12}$

(b) $\frac{x-2}{2}+\frac{x-1}{3}$

Solution: $\frac{x-2}{2}+\frac{x-1}{3} = \frac{3(x-2)+2(x-1)}{6} = \frac{3x-6+2x-2}{6} = \frac{5x-8}{6}$

(c) $\frac{2x+1}{3}-\frac{x+1}{4}$

Solution: $\frac{2x+1}{3}-\frac{x+1}{4} = \frac{8(2x+1)-3(x+1)}{24} = \frac{16x+8-3x-3}{24} = \frac{13x+5}{24}$

(d) $\frac{3x-1}{4}-\frac{2x-1}{6}$

Solution: $\frac{3x-1}{4}-\frac{2x-1}{6} = \frac{9(3x-1)-4(2x-1)}{36} = \frac{27x-9-8x+4}{36} = \frac{19x-5}{36}$

8. Expand and simplify: 16

(a) $(x+3)(x+5)$

Solution: $(x+3)(x+5) = x^2+5x+3x+15 = x^2+8x+15$

(b) $(x+7)(x-3)$

Solution: $(x+7)(x-3) = x^2-3x+7x-21 = x^2+4x-21$

(c) $(x-3)(x+8)$

Solution: $(x-3)(x+8) = x^2+8x-3x-24 = x^2+5x-24$

(d) $(2x+1)(3x-2)$

Solution: $(2x+1)(3x-2) = 6x^2-4x+3x-2 = 6x^2-x-2$

(e) $(4x+3)(3x+5)$

Solution: $(4x+3)(3x+5) = 12x^2+20x+9x+15 = 12x^2+29x+15$

(f) $(5x-2)(2x+3)$

Solution: $(5x-2)(2x+3) = 10x^2+15x-4x-6 = 10x^2+11x-6$

(g) $(x+5)(x-5)$

Solution: $(x+5)(x-5) = x^2-5x+5x-25 = x^2-25$

(h) $(2x+3)(2x-3)$

Solution: $(2x+3)(2x-3) = 4x^2-6x+6x-9 = 4x^2-9$

(i) $(3x-5)(3x+5)$

Solution: $(3x-5)(3x+5) = 9x^2+15x-15x-25 = 9x^2-25$

(j) $(x+7)^2$

Solution: $(x+7)^2 = x^2+14x+49$

(k) $(2x-5)^2$

Solution: $(2x-5)^2 = 4x^2-20x+25$

(l) $(3x-4)^2$

Solution: $(3x-4)^2 = 9x^2-24x+16$

(m) $(x+2)^2-(x-4)^2$

Solution: $(x+2)^2-(x-4)^2 = x^2+4x+4-(x^2-8x+16) = 12x-12$

(n) $(2x+3)^2-(2x-3)^2$

Solution: $(2x+3)^2-(2x-3)^2 = 4x^2+12x+9-(4x^2-12x+9) = 24x$

(o) $(x+1)(2x+3)+(2x-1)(3x+2)$

Solution: $(x+1)(2x+3)+(2x-1)(3x+2) = 2x^2+3x+2x+3+6x^2+4x-3x-2 = 8x^2+6x+1$

(p) $(x+2)(2x-5)-(3x+1)(2x-4)$

(q)

Solution:

$$(x+2)(2x-5)-(3x+1)(2x-4)$$

Solution: $(x+2)(2x-5)-(3x+1)(2x-4)$
$= 2x^2-5x+4x-10-(6x^2-12x+3x-4)$
$= 2x^2-x-10-6x^2+12x-3x+4$
$= -4x^2+8x-6$

9. Fill in the missing gaps: 6

(a) $(x+3)(x+7) = x^2 + 10x + 21$

Solution: $(x+3)(x+7)$

$= x^2 + 7x + 3x + 21$

$= x^2 + 10x + 21$

(b) $(x+2)(x-3) = x^2 - x - 6$

Solution: $(x+2)(x-3)$

$= x^2 - 3x + 2x - 6$

$= x^2 - x - 6$

(c) $(x+6)(5+x) = x^2 + 11x + 30$

Solution: $(x+6)(5+x)$

$= x^2 + 5x + 6x + 30$

$= x^2 + 11x + 30$

(d) $(x+4)(6+x) = x^2 + 10x + 24$

Solution: $(x+4)(6+x)$

$= x^2 + 6x + 4x + 24$

$= x^2 + 10x + 24$

(e) $(2x-1)(x+3) = 2x^2 + 5x - 3$

Solution: $(2x-1)(x+3)$

$= 2x^2 + 6x - x - 3$

$= 2x^2 + 5x - 3$

(f) $(3x+2)(2x+7) = 6x^2 + 23x + 14$

Solution: $(3x+2)(2x+7)$

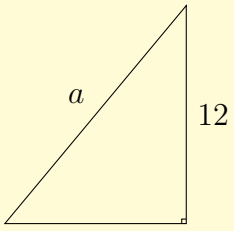
$= 6x^2 + 21x + 4x + 14$

$= 6x^2 + 23x + 14$

3 Pythagoras' Theorem and Surds

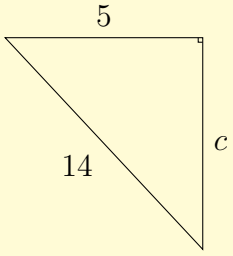
1. For each of these right-angled triangles, find the value of the pronumeral, correct to 1 decimal place. [4]

(a)



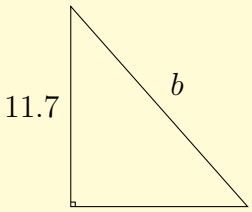
Solution: $a = \sqrt{8^2 + 12^2} = \sqrt{64 + 144} = \sqrt{208} \approx 14.42$

(c)



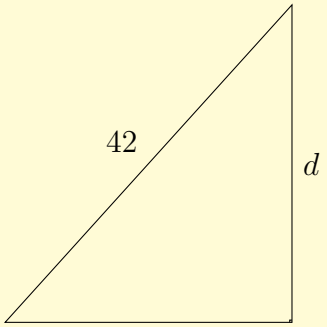
Solution: $c = \sqrt{14^2 - 5^2} = \sqrt{196 - 25} = \sqrt{171} \approx 13.07$

(b)



Solution: $b = \sqrt{6.2^2 + 11.7^2} = \sqrt{38.44 + 136.89} = \sqrt{175.33} \approx 13.24$

(d)



Solution: $d = \sqrt{42^2 - 18^2} = \sqrt{1764 - 324} = \sqrt{1440} \approx 37.95$

2. The lengths of the sides of a triangle are 8.2 cm, 11.6 cm and 14.3 cm. Is the triangle right-angled? [2]

Solution: To check if the triangle is right-angled, use Pythagoras' theorem: $8.2^2 + 11.6^2 \approx 67.24 + 134.56 = 201.8$ $14.3^2 \approx 204.49$ Since 201.8 is not equal to 204.49, the triangle is not right-angled.

3. In each part below, the two shorter side lengths of a right-angled triangle are given. State the length of the hypotenuse. [6]

(a) 3 cm, 4 cm

Solution: Hypotenuse $= \sqrt{3^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = 5$ cm

(b) 5 cm, 12 cm

Solution: Hypotenuse $= \sqrt{5^2 + 12^2} = \sqrt{25 + 144} = \sqrt{169} = 13$ cm

(c) 4 cm, 7.5 cm

Solution: Hypotenuse $= \sqrt{4^2 + 7.5^2} = \sqrt{16 + 56.25} = \sqrt{72.25} \approx 8.5$ cm

(d) 0.3 cm, 0.4 cm

Solution: Hypotenuse $= \sqrt{0.3^2 + 0.4^2} = \sqrt{0.09 + 0.16} = \sqrt{0.25} = 0.5$ cm

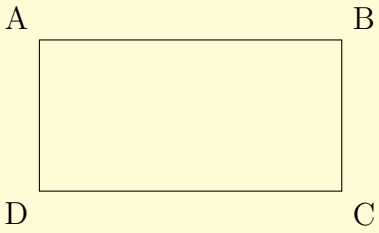
(e) 1 cm, 2.4 cm

Solution: Hypotenuse $= \sqrt{1^2 + 2.4^2} = \sqrt{1 + 5.76} = \sqrt{6.76} \approx 2.6$ cm

(f) 12 cm, 22.5 cm

Solution: Hypotenuse $= \sqrt{12^2 + 22.5^2} = \sqrt{144 + 506.25} = \sqrt{650.25} \approx 25.5$ cm

4. A gardener is designing a rectangular lawn $ABCD$. If $AB = 4.2$ m and $BC = 3.15$ m, how far apart should A and C be to ensure $\angle ABC = 90°$? [2]



Solution: Diagonal $AC = \sqrt{AB^2 + BC^2} = \sqrt{4.2^2 + 3.15^2} = \sqrt{17.64 + 9.9225} = \sqrt{27.5625} \approx 5.25$ m

5. A plane takes off and after climbing on a straight line path for a distance of 1 km, it has flown a horizontal distance of 900 m. What is the plane's altitude, correct to the nearest metre? [3]

Solution: Altitude $= \sqrt{1^2 - 0.9^2} = \sqrt{1 - 0.81} = \sqrt{0.19} \approx 435.89$ m ≈ 436 m

6. Simplify each of these surds. [6]

(a) $\sqrt{20}$

Solution: $\sqrt{20} = \sqrt{4 \cdot 5} = 2\sqrt{5}$

(b) $\sqrt{75}$

Solution: $\sqrt{75} = \sqrt{25 \cdot 3} = 5\sqrt{3}$

(c) $2\sqrt{18}$

Solution: $2\sqrt{18} = 2\sqrt{9 \cdot 2} = 2 \cdot 3\sqrt{2} = 6\sqrt{2}$

(d) $4\sqrt{50}$

Solution: $4\sqrt{50} = 4\sqrt{25 \cdot 2} = 4 \cdot 5\sqrt{2} = 20\sqrt{2}$

(e) $5\sqrt{108}$

Solution: $5\sqrt{108} = 5\sqrt{36 \cdot 3} = 5 \cdot 6\sqrt{3} = 30\sqrt{3}$

(f) $9\sqrt{27}$

Solution: $9\sqrt{27} = 9\sqrt{9 \cdot 3} = 9 \cdot 3\sqrt{3} = 27\sqrt{3}$

7. Write each number as the square root of a whole number. [4]

(a) $2\sqrt{3}$

Solution: $2\sqrt{3} = \sqrt{4 \cdot 3} = \sqrt{12}$

(b) $3\sqrt{2}$

Solution: $3\sqrt{2} = \sqrt{9 \cdot 2} = \sqrt{18}$

(c) $10\sqrt{5}$

Solution: $10\sqrt{5} = \sqrt{100 \cdot 5} = \sqrt{500}$

(d) $4\sqrt{7}$

Solution: $4\sqrt{7} = \sqrt{16 \cdot 7} = \sqrt{112}$

8. Simplify: [8]

(a) $4\sqrt{2}+7\sqrt{2}$

Solution: $4\sqrt{2}+7\sqrt{2}=(4+7)\sqrt{2}=11\sqrt{2}$

(b) $8\sqrt{3}-5\sqrt{3}$

Solution: $8\sqrt{3}-5\sqrt{3}=(8-5)\sqrt{3}=3\sqrt{3}$

(c) $4\sqrt{2}\times 5\sqrt{3}$

Solution: $4\sqrt{2}\times 5\sqrt{3}=20\sqrt{2\cdot 3}=20\sqrt{6}$

(d) $3\sqrt{5}\times 4\sqrt{7}$

Solution: $3\sqrt{5}\times 4\sqrt{7}=12\sqrt{5\cdot 7}=12\sqrt{35}$

(e) $\sqrt{18}+\sqrt{32}$

Solution: $\sqrt{18}+\sqrt{32}=\sqrt{9\cdot 2}+\sqrt{16\cdot 2}=3\sqrt{2}+4\sqrt{2}=7\sqrt{2}$

(f) $\sqrt{27}-\sqrt{12}$

Solution: $\sqrt{27}-\sqrt{12}=\sqrt{9\cdot 3}-\sqrt{4\cdot 3}=3\sqrt{3}-2\sqrt{3}=\sqrt{3}$

(g) $4\sqrt{12}+3\sqrt{75}$

Solution: $4\sqrt{12}+3\sqrt{75}=4\sqrt{4\cdot 3}+3\sqrt{25\cdot 3}=8\sqrt{3}+15\sqrt{3}=23\sqrt{3}$

(h) $8\sqrt{50}-2\sqrt{98}$

Solution: $8\sqrt{50}-2\sqrt{98}=8\sqrt{25\cdot 2}-2\sqrt{49\cdot 2}=40\sqrt{2}-14\sqrt{2}=26\sqrt{2}$

9. Expand and simplify: 8

(a) $\sqrt{2}(\sqrt{3}+\sqrt{10})$

Solution: $\sqrt{2}\sqrt{3}+\sqrt{2}\sqrt{10} = \sqrt{6}+\sqrt{20} = \sqrt{6}+2\sqrt{5}$

(b) $\sqrt{3}(4\sqrt{3}-5)$

Solution: $\sqrt{3}\cdot 4\sqrt{3}-\sqrt{3}\cdot 5 = 4\cdot 3-5\sqrt{3} = 12-5\sqrt{3}$

(c) $3\sqrt{5}(2\sqrt{2}-4\sqrt{5})$

Solution: $3\sqrt{5}\cdot 2\sqrt{2}-3\sqrt{5}\cdot 4\sqrt{5} = 6\sqrt{10}-3\cdot 4\cdot 5 = 6\sqrt{10}-60$

(d) $2\sqrt{2}(3\sqrt{3}+4\sqrt{2})$

Solution: $2\sqrt{2}\cdot 3\sqrt{3}+2\sqrt{2}\cdot 4\sqrt{2} = 6\sqrt{6}+2\cdot 4\cdot 2 = 6\sqrt{6}+16$

(e) $(2\sqrt{3}+1)(3\sqrt{3}-2)$

Solution: $(2\sqrt{3})(3\sqrt{3})+(2\sqrt{3})(-2)+1(3\sqrt{3})-1(2) = 6\cdot 3-4\sqrt{3}+3\sqrt{3}-2 = 18-\sqrt{3}-2$

(f) $(4\sqrt{2}+3)(5\sqrt{2}-7)$

Solution: $(4\sqrt{2})(5\sqrt{2})+(4\sqrt{2})(-7)+3(5\sqrt{2})-3(7) = 4\cdot 5\cdot 2-28\sqrt{2}+15\sqrt{2}-21 = 40-13\sqrt{2}-21$

(g) $(3\sqrt{2}-1)^2$

Solution: $(3\sqrt{2})^2-2(3\sqrt{2})(1)+1^2 = 9\cdot 2-6\sqrt{2}+1 = 18-6\sqrt{2}+1$

(h) $(\sqrt{5}+1)^2$

Solution: $(\sqrt{5})^2+2(\sqrt{5})(1)+1^2 = 5+2\sqrt{5}+1 = 6+2\sqrt{5}$

(i) $(2\sqrt{5}+7\sqrt{2})(2\sqrt{5}-7\sqrt{2})$

Solution: $(2\sqrt{5})^2-(7\sqrt{2})^2 = 4\cdot 5-7^2\cdot 2 = 20-49\cdot 2 = 20-98 = -78$

10. Express each number with a rational denominator. [4]

(a) $\dfrac{3}{\sqrt{3}}$

Solution: $\frac{3}{\sqrt{3}}\cdot\frac{\sqrt{3}}{\sqrt{3}} = \frac{3\sqrt{3}}{3} = \sqrt{3}$

(b) $\dfrac{2\sqrt{5}}{\sqrt{5}}$

Solution: $\frac{2\sqrt{5}}{\sqrt{5}} = 2$

(c) $\dfrac{2}{4\sqrt{3}}$

Solution: $\frac{2}{4\sqrt{3}}\cdot\frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{12} = \frac{\sqrt{3}}{6}$

(d) $\dfrac{5\sqrt{3}}{3\sqrt{2}}$

Solution: $\frac{5\sqrt{3}}{3\sqrt{2}}\cdot\frac{\sqrt{2}}{\sqrt{2}} = \frac{5\sqrt{6}}{3\cdot 2} = \frac{5\sqrt{6}}{6}$

11. Express each number with a rational denominator. [4]

(a)

$$\frac{3\sqrt{2}}{\sqrt{5}+2}$$

Solution: $\frac{3\sqrt{2}}{\sqrt{5}+2} \cdot \frac{\sqrt{5}-2}{\sqrt{5}-2} = \frac{3\sqrt{2}(\sqrt{5}-2)}{5-4} = 3\sqrt{10} - 6\sqrt{2}$

(b)

$$\frac{\sqrt{3}}{2\sqrt{3}-1}$$

Solution: $\frac{\sqrt{3}}{2\sqrt{3}-1} \cdot \frac{2\sqrt{3}+1}{2\sqrt{3}+1} = \frac{\sqrt{3}(2\sqrt{3}+1)}{3-1} = \frac{2\cdot 3+\sqrt{3}}{2} = 3 + \frac{\sqrt{3}}{2}$

(c)

$$\frac{3\sqrt{2}+1}{\sqrt{5}+2}$$

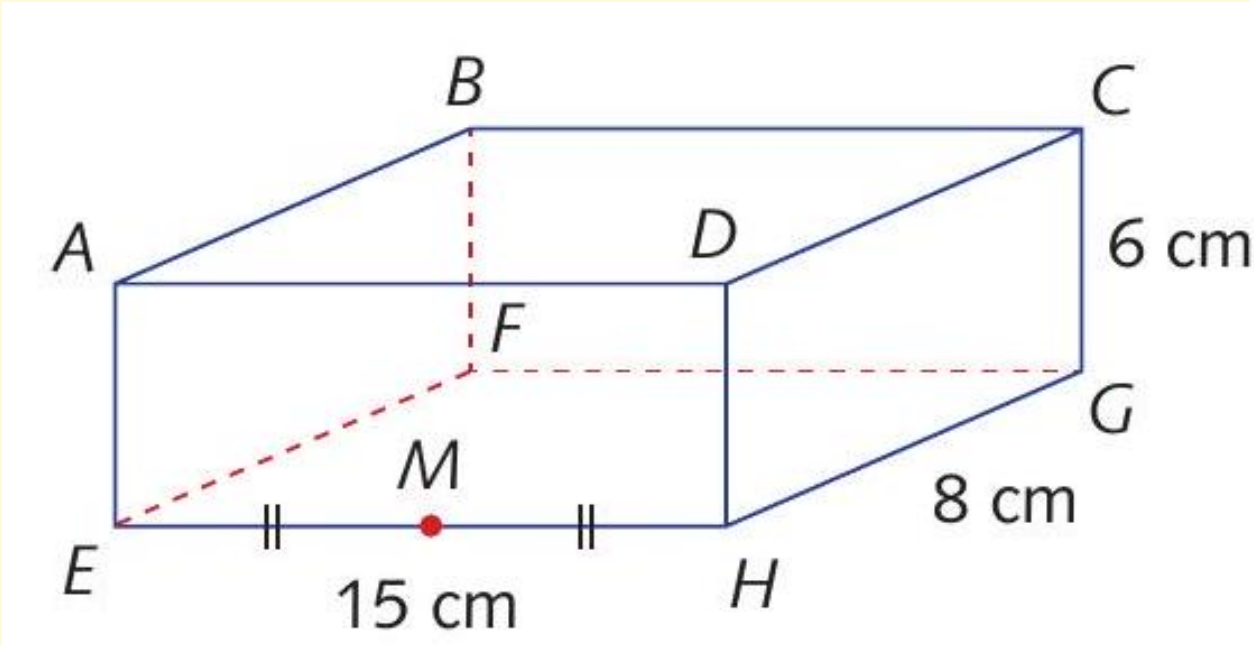
Solution: $\frac{3\sqrt{2}+1}{\sqrt{5}+2} \cdot \frac{\sqrt{5}-2}{\sqrt{5}-2} = \frac{(3\sqrt{2}+1)(\sqrt{5}-2)}{5-4} = 3\sqrt{10} - 6\sqrt{2} + \sqrt{5} - 2$

(d)

$$\frac{\sqrt{2}+1}{\sqrt{3}+\sqrt{2}}$$

Solution: $\frac{\sqrt{2}+1}{\sqrt{3}+\sqrt{2}} \cdot \frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}-\sqrt{2}} = \frac{\sqrt{2}(\sqrt{3}-\sqrt{2})+1(\sqrt{3}-\sqrt{2})}{3-2} = \sqrt{6} - 2 + \sqrt{3} - \sqrt{2}$

12. For the rectangular prism to the right, calculate the length of each of these intervals. Give your answers as surds in simplest form. [6]



(a) EG

Solution:

(d) GM

Solution:

(b) EC

Solution:

(e) CM

Solution:

(c) HC

Solution:

(f) AM

Solution:

13. A vase is in the shape of a cylinder with base radius 4 cm and height 10 cm. What is the length, correct to 1 decimal place, of the longest flower stem that can just fit in the vase? [2]

Solution: The longest stem that can fit into the vase is the diagonal of the cylinder. This can be calculated using the Pythagorean theorem for the diagonal (d) of the cylinder with radius (r) and height (h):

$$d = \sqrt{r^2 + h^2}$$

$$d = \sqrt{4^2 + 10^2}$$

$$d = \sqrt{16 + 100}$$

$$d = \sqrt{116}$$

$$d \approx 10.8 \text{ cm}$$

4 Consumer Arithmetic

1. Express each percentage as a fraction in its simplest form. [6]

(a) 18%

Solution: $\frac{18}{100} = \frac{9}{50}$

(b) 64%

Solution: $\frac{64}{100} = \frac{16}{25}$

(c) 2.6%

Solution: $\frac{2.6}{100} = \frac{26}{1000} = \frac{13}{500}$

(d) 8.5%

Solution: $\frac{8.5}{100} = \frac{85}{1000} = \frac{17}{200}$

(e) $37\frac{1}{2}\%$

Solution: $37.5\% = \frac{37.5}{100} = \frac{375}{1000} = \frac{3}{8}$

(f) $6\frac{2}{3}\%$

Solution: $6\frac{2}{3}\% = \frac{20}{3} \times \frac{1}{100} = \frac{20}{300} = \frac{2}{30} = \frac{1}{15}$

2. Express each percentage as a decimal. 6

(a) 8%

Solution: 0.08

(b) 27%

Solution: 0.27

(c) 9.6%

Solution: 0.096

(d) 45.8%

Solution: 0.458

(e) $12\frac{1}{4}\%$

Solution: $12.25\% = 0.1225$

(f) $38\frac{1}{2}\%$

Solution: $38.5\% = 0.385$

3. Express each rational number as a percentage. 6

(a) $\frac{2}{5}$

Solution: $\frac{2}{5} = 0.4 = 40\%$

(b) $\frac{5}{8}$

Solution: $\frac{5}{8} = 0.625 = 62.5\%$

(c) 0.61

Solution: $0.61 = 61\%$

(d) 0.02

Solution: $0.02 = 2\%$

(e) $\frac{4}{7}$

Solution: $\frac{4}{7} \approx 0.5714 = 57.14\%$

(f) $\frac{5}{9}$

Solution: $\frac{5}{9} \approx 0.5556 = 55.56\%$

4. Complete the following table. [12]

	Percentage	Fraction	Decimal
a	25%	$\frac{1}{4}$	0.25
b	30%	$\frac{3}{10}$	0.3
c	26%	$\frac{13}{50}$	0.26
d	66.67%	$\frac{2}{3}$	0.6667
e	8%	$\frac{2}{25}$	0.08
f	7.5%	$\frac{3}{40}$	0.075

5. Calculate: [4]

   (a) 8% of 120

   Solution: $120 \times 0.08 = 9.6$

   (b) 16% of 54

   Solution: $54 \times 0.16 = 8.64$

   (c) 85% of \$400

   Solution: $400 \times 0.85 = \$340$

   (d) $9\frac{1}{2}$% of \$6000

   Solution: $6000 \times 0.095 = \$570$

6. There are 650 students at a high school, 54% of whom are boys. How many boys are at the school? [2]

   Solution: $650 \times 0.54 = 351$

7. Netball is played by 6% of Australians. If the population of Australia is 22500000 , how many Australians play netball? [2]

   Solution: $22500000 \times 0.06 = 1350000$

8. In a class of 25 students, 8 travel to school by train. What percentage of the class travel to school by train? [2]

Solution: $\frac{8}{25} = 0.32 = 32\%$

9. In a survey of 1200 adults, it was discovered that 114 of them were unemployed. What percentage of the adults surveyed were unemployed? [2]

Solution: $\frac{114}{1200} = 0.095 = 9.5\%$

10. Find the new value if: [4]

(a) 80 is increased by 40%

Solution: $80 \times 1.40 = 112$

(b) 150 is increased by 6%

Solution: $150 \times 1.06 = 159$

(c) 240 is decreased by 12%

Solution: $240 \times 0.88 = 211.2$

(d) 160 is decreased by 4%

Solution: $160 \times 0.96 = 153.6$

11. During a sale, the price of a sofa bed is reduced by 20%. If the original price of the bed was \$650, what is its sale price? [2]

Solution: $650 \times 0.80 = \$520$

12. A salesperson is given a salary increase of 4%. If her existing weekly salary is \$640, what will her new weekly salary be? [2]

Solution: $640 \times 1.04 = \$665.60$

13. Joe's Electrical Store is having an 8% discount sale. The sale price of some items is given below. Calculate the price of the items before they were reduced. [2]

Solution:

(a) Heater \$276

Solution: $276 \div 0.92 = \$300$

(b) Vacuum cleaner \$138

Solution: $138 \div 0.92 = \$150$

(c) Dishwasher \$690

Solution: $690 \div 0.92 = \$750$

(d) Microwave \$132.80

Solution: $132.80 \div 0.92 = \$144.35$

14. The enrolment of a school increased from 680 to 740 . Calculate the percentage increase, correct to 2 decimal places. [2]

Solution: $\frac{740-680}{680} \times 100 \approx 8.82\%$

15. During a sale the price of a suit is reduced from \$420 to \$370. Calculate the percentage discount, correct to 1 decimal place. [2]

Solution: $\frac{420-370}{420} \times 100 \approx 11.9\%$

16. What single percentage change, correct to 2 decimal places, is equivalent to each of these multiple changes? [4]

(a) A 6% increase followed by a 12% increase

Solution: $1.06 \times 1.12 = 1.1872 \approx 18.72\%$ increase

(b) A 10% increase followed by a 10% decrease

Solution: $1.10 \times 0.90 = 0.99 = 1\%$ decrease

(c) A 16% decrease followed by a 8% decrease

Solution: $0.84 \times 0.92 = 0.7728 \approx 22.72\%$ decrease

(d) A 12% decrease followed by a 14% increase

Solution: $0.88 \times 1.14 = 1.0032 \approx 0.32\%$ increase

17. Over the course of a year an employee is given successive salary increases of $4\%, 6\%$ and 5%. [2]

Solution:

(a) If the employee's original monthly salary was \$2600, what is the employee's salary after the three increases?

Solution: $2600 \times 1.04 \times 1.06 \times 1.05 = \$3038.28$

(b) What single percentage change is equivalent to the three successive salary increases?

Solution: $1.04 \times 1.06 \times 1.05 = 1.1688 \approx 16.88\%$ increase

18. To obtain a bonus, a salesperson's sales must increase by 20% in a two-month period. If the salesperson's sales increase by 8% in the first month, by what percentage must they increase in the second month to ensure the bonus is obtained? [2]

Solution: Let x be the required percentage increase for the second month. $1.08 \times (1 + \frac{x}{100}) = 1.20$ $1 + \frac{x}{100} = \frac{1.20}{1.08}$ $\frac{x}{100} = \frac{1.20}{1.08} - 1$ $x = (1.1111 - 1) \times 100$ $x \approx 11.11\%$

19. Mia invests \$6000 in the bank. How much will she have in her account after three years if the bank pays: [2]

(a) 8% simple interest p.a.

Solution: $6000 + (6000 \times 0.08 \times 3) = 6000 + 1440 = \$7440$

(b) 4% compound interest p.a.

Solution: $6000 \times (1 + 0.04)^3 \approx 6000 \times 1.124864 = \$6749.18$

20. The value of a new car depreciates at a compound rate of 6% each year. If the car has an initial value of \$19960, calculate its value after: [3]

(a) one year

Solution: $19960 \times (1 - 0.06) = 19960 \times 0.94 = \$18762.40$

(b) five years

Solution: $19960 \times (1 - 0.06)^5 \approx 19960 \times 0.747258 = \$14920.47$

(c) 10 years

Solution: $19960 \times (1 - 0.06)^{10} \approx 19960 \times 0.558395 = \$11145.89$

5 Factorisation

1. Factorise: [8]

(a) $5a + 10$

Solution: $5(a + 2)$

(b) $6c - 8$

Solution: $2(3c - 4)$

(c) $9d - 24$

Solution: $3(3d - 8)$

(d) $3e^2 + 9e$

Solution: $3e(e + 3)$

(e) $6f^2 + 10f$

Solution: $2f(3f + 5)$

(f) $-3h^2 - 15h$

Solution: $-3h(h + 5)$

(g) $4a^2b + 6ab^2$

Solution: $2ab(2a + 3b)$

(h) $9mn^2 + 12mn$

Solution: $3mn(3n + 4)$

2. Factorise: [12]

(a) $x^2 + 7x + 12$

Solution: $(x + 3)(x + 4)$

(b) $x^2 - 9x + 18$

Solution: $(x - 3)(x - 6)$

(c) $x^2 - 5x - 6$

Solution: $(x - 6)(x + 1)$

(d) $x^2 + 3x - 28$

Solution: $(x - 4)(x + 7)$

(e) $x^2 - 11x + 30$

Solution: $(x - 5)(x - 6)$

(f) $x^2 - 14x + 24$

Solution: $(x - 2)(x - 12)$

(g) $x^2 - 6x - 55$

Solution: $(x - 11)(x + 5)$

(h) $3x^2 + 6x + 9$

Solution: $3(x + 1)^2$

(i) $4x^2 - 8x + 12$

Solution: $4(x - 1)(x - 3)$

(j) $x^2 - 100$

Solution: $(x - 10)(x + 10)$

(k) $9x^2 - 16y^2$

Solution: $(3x - 4y)(3x + 4y)$

(l) $1 - 16a^2$

Solution: $(1 - 4a)(1 + 4a)$

3. Write each expression as a simplified single fraction. 8

(a) $\dfrac{1}{(x-1)^2} \div \dfrac{1}{x^2-1}$

Solution: $\dfrac{x+1}{x-1}$

(b) $\dfrac{x-4}{x^2+2x+1} \times \dfrac{x+1}{x^2-16}$

Solution: $\dfrac{x-4}{(x+1)(x-4)}$

(c) $\dfrac{m-2}{4m} \times \dfrac{m}{m-2}$

Solution: $\dfrac{1}{4}$

(d) $\dfrac{p+1}{8(p-1)} \times \dfrac{4(p-1)}{(p+1)(p+2)}$

Solution: $\dfrac{1}{2(p+2)}$

(e) $\dfrac{4}{a} \div \dfrac{2}{a^2}$

Solution: $\dfrac{2a}{1}$

(f) $\dfrac{5a-7}{2a+4} \times \dfrac{12}{10a-14}$

Solution: $\dfrac{3}{1}$

(g) $\dfrac{x^2+3x-4}{2x-2} \times \dfrac{6x-12}{x-1}$

Solution: $\dfrac{3(x+4)}{1}$

(h) $\dfrac{x^3}{y^2} \div \dfrac{x}{2y^3}$

Solution: $\dfrac{2x^2}{y}$

6 Homework

This week homework is a little different. The only thing that will be marked from you is a reattempt of every single question that you got incorrect on the class quiz. Tutors should have handed out an extra quiz for each student.

Question	Points	Score
1	8	
2	12	
3	8	
4	12	
5	4	
6	2	
7	2	
8	2	
9	2	
10	4	
11	2	
12	2	
13	2	
14	2	
15	2	
16	4	
17	2	
18	2	
19	2	
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