MATHS

BOOKS - CENGAGE

ALGEBRAIC EXPRESSIONS

Worked Examples

1. If $f(x)$ stands for $3x^2 + 5x + 7$, determine the value of $f(0)$,

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2. If $f(x)$ stands for $3x^2 + 5x + 7$, determine the value of $f(1)$

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3. If $f(x)$ stands for $3x^2 + 5x + 7$, determine the value of $f(2) + f(3)$

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4. If $f(x)$ stands for $3x^2 + 5x + 7$, determine the value of $f(-2)$.

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5. $a^3 + b^3 - c^3 + 3abc$

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6. $8a^3 - 27b^3 - c^3 - 18abc$

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7. $8p^3 - 1 - m^3 - 6m$

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8. $\sum a^2(b - c) = a^2(b - c) + b^2(c - a) + c^2(a - b)$

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9.

$$\sum x^2 y^2 (x - y) = x^2 y^2 (x - y) + y^2 z^{92}\Big)(y - z) + z^2 x^2 (z - x)$$

10. $\sum a^3 (b - c)$

11. Factorise $P + 2abc$ if $P = \sum a^2 (b + c)$.

12. Factorise $P + 3abc$ if $P = \sum bc(b + c)$.

13. Factorise $(a + b + c)(bc + ca + ab) - abc$

14. Factorise $(a + b + c)^3 - a^3 - b^3 - c^3.$

15. Factorise $2b^2c^2 + 2c^2a^2 + 2a^2b^2 - a^4 - b^4 - c^4.$

16. Show that

$$a^2(b - c) + b^2(c - a) + c^2(a - b) = -(b - c)(c - a)(a - b)$$

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17. Factorise $a^3(b - c) + b^3(c - a) + c^3(a - b)$.

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Test Yourself Level 1

1. If $f(x, y) = 2x^2 - 5xy + 3y^2$, find the following:

$f(1, -1)$

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2. If $f(x, y) = 2x^2 - 5xy + 3y^2$, find the following:

$f(0, a)$

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3. If $f(x) = 3x^2 + x - 5$, find the following:

$f(1)$

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4. If $f(x) = 3x^2 + x - 5$, find the following:

$f(-1)$

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5. If $f(x) = 3x^2 + x - 5$, find the following:

$f(0)$

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6. If $f(x) = 3x^2 + x - 5$, find the following:

$f(a)$

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7. If $f(x) = 3x^2 - 4x - 6$, find $f(1) + f(2) + f(3)$.

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8. If $f(x) = x^2 + 2x + 1$, find $\dfrac{f(xh) - f(x)}{h}$.

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9. If $f(x) = \dfrac{2x}{1 - x^2}$, show that $f\left(\dfrac{1}{t}\right) + f(t) = 0$.

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10. Expand the following:

$$\sum a^2 b$$

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11. Expand the following:

$$\sum bc(b - c)$$

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12. Expand the following:

$$\sum a(b - c)^2$$

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13. Expand the following:

$$\sum (b - c)$$

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14. Expand the following:

$$\sum a(b - c)$$

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15. Simplify the following:

$$\sum (x + y)$$

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16. Express the following using $\sum$ notation:

$$a^2 bc + b^2 ca + c^2 ab$$

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17. Express the following using $\sum$ notation:

$$(x - y)^2 + (y - z)^2 + (z - x)^2$$

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18. Write down a homogeneous expression in $x,$ and y of the following:

The second degree

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19. Write down a homogeneous expression in $x,$ and y of the following:

The third degree

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20. Write $a^2\left(c^2 - b^2\right) + b^2\left(a^2 - c^2\right) + c^2\left(b^2 - a^2\right)$ in cyclic order.

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Test Yourself Level 2

1. If $f(x) = ax + b$, $f(1) = 5$ and $f(2) = 7$, find and b.

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2. If $f(-1) = 12$ and $f(2) = 3$ find the function in the form $px + q$.

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3. If $y = \dfrac{2x}{x+1}$, find x in terms of y.

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4. If $f(x) = \dfrac{2x+1}{x-2}$, find $f[f(x)]$.

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5. If $y = 2x + 3$, find x in terms of y.

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6. Factorise the following:

$$x\left(y^2 - z^2\right) + y\left(z^2 - x^2\right) + z\left(x^2 - y^2\right)$$

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7. Factorise the following:

$$x^2\left(y - z\right) + y^2\left(z - x\right) + z^2\left(x - y\right)$$

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8. Factorise the following:

$$(a \div b + c)(bc + ca + ab) - abc$$

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9. Factorise the following:

$$xy(x - y) + yz(y - z) + zx(z - x)$$

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10. Factorise the following:

$$a^2(b + c) + b^2(c + a) + c^2(a + b) + 2abc$$

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11. Factorise the following:

$$\sum a(b - c)^3$$

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12. If $y = \dfrac{ax + b}{bx - a}$, find x in terms of y,

13. If $y = \dfrac{4x + 3}{x - 3}$, find x in terms of y.

Test Yourself Level 3

1. If $f(a) = 3a^2 + 4a + 1$, show that $\dfrac{f(a + x) - f(a - x)}{f(x) - f(-x)} = \dfrac{3a + 2}{2}$.

2. If $f(x) = x^2 - x + 1$, find $(x + 1)f(x) - (x - 1)f(x + 1)$.

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3. If $m = f(t) = (t - 1)(t - 2)$, find $f(m)$ in terms of t.

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4. Factorise the following:

$$a(b^2 + c^2) + b(c^2 + a^2) + c(a^2 + b^2) + 3abc$$

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5. Factorise the following:

$$a^3(b - c) + b^3(c - a) + c^3(a - b)$$

6. Factorise the following:

$$2y^2 z^2 + 2z^2 x^2 + 2x^2 y^2 - x^4 - y^4 - z^4$$

7. Factorise the following:

$$a(b - c)^3 + b(c - a)^3 + c(a - b)^3$$

8. Factorise the following:

$$bc(b + c) + ca(c + a) + ab(a + b) + 3abc$$

9. Factorise the following:

$$\sum a^4(b - c)$$

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10. Factorise the following:

$$\sum bc(b^3 - c^3)$$

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11. Factorise the following:

$$\sum x^2 y^2 (x - y)$$

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12. Factorise the following:

$$\sum x^2(y-z)^3$$

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13. Factorise the following:

$$\sum b^2 c^2 (b^2 - c^2)$$

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14. Factorise the following:

$$(a+b+c)^5 - a^5 - b^5 - c^5$$

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15. Factorise the following:

$$\sum a(b^2 - c^2)$$

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16. Factorise the following:

$$(a + b + c)^3 - (b + c - a)^3 - (c + a - b)^3 - (a + b - c)^3$$

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17. Factorise the following:

$$(ab + bc + ca)^2 - a^2b^2 - b^2 - b^2c^2 - c^2a^2$$

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1. If $a + b + c = 0$, then find the value of $a^3 + b^3 + c^3$.

A. abc

B. 3abc

C. $(a + b)(c + a)(b + c)$

D. none of these

Answer: B

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2. Which of the following is a factor of $8a^3 - 27b^3 - c^3 - 18abc$?

A. $(3a - 2b - c)$

B. $(3a - b - c)$

C. $(2a - 3b - c)$

D. none of these

Answer: C

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3. If $8p^{-3} - 1 - m^3 - 6 \pm = 0$, then which of the following is correct?

A. $2p = 1 + m$

B. $p = 1 + 2m$

C. $p + m = 2$

D. $2p = 1 + 2m$

Answer: A

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4. The simplest form of the expression $x^2y^2(x-y) + y^2z^2(y-z) + z^2x^2(z-x)$ is

A. $(x+y)(y+z)(z+x)(xy+yz+zx)$

B. $(x-y)(y-z)(z-x)(xy-yz-zx)$

C. $(x-y)(y+z)(z+x)(xy+yz+zx)$

D. $-(x-y)(y-z)(z-x)(xy+yz+zx)$

Answer: D

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5. If a, b and c are all distinct positive, then find the value of $a + b + c$ if $a^3(b - c) + b^3(c - a) + c^3(a - b) = 0$.

A. 0

B. 1

C. 2

D. 3

Answer: A

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6. If $f(x, y) = 5x^2 - 10xy + 12y^2$ and $f(a, 3) = f(2, a)$, then which of the following is correct?

A. $7a^2 + 10a - 88 = 0$

B. $a^2 + 6a + 8 = 0$

C. $7a^2 + 10a + 88 = 0$

D. none of these

Answer: A

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7. If $f(x) = 4x^4 + x^2 + 5b$ and $f(1) = f(-1)$, then what is the value of b?

A. $b \neq 0$

B. $b \in R$

C. no value of b is possible

D. none of these

Answer: B

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8. If $f(x) = 2x^2 - 3x + 2,$ then the value of $f(0) + f(1) + f(2)$ is

A. 7

B. 8

C. 10

D. 11

Answer: A

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9. If $f(x) = ax^2 + bx + c$ such that $f(-1)$, $f(0)$ and $f(1)$ are in A.P., then which of the following is correct?

    A. $c = b$

    B. $b \neq 0$

    C. $c \neq 0$

    D. $a = 0$

Answer: D

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10. Let $f(x) = px^2 + qx + r$, where p, q and r are in A.P. If $f(1) = 3$, then which of the following is correct?

A. $q = 1$

B. $p + q = 1$

C. $p - r = 1$

D. none of these

Answer: A

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11. Which of the following expressions is homogeneous in terms of x and y?

A. $x^2 + xy + 3$

B. $x^2 + 2xy + 7y^2$

C. $x^2 - y^2 + 3x$

D. $x^2 + y^2 - xy^2$

Answer: B

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12. If $f(x) = \dfrac{x+1}{x-1}$, then $f(f(x)) =$

A. x

B. $\dfrac{x-1}{x+1}$

C. $\dfrac{x^2+1}{x^2-1}$

D. $\dfrac{1}{x}$

Answer: A

13. If $f(x) = x^2 - x + 1$, then what is the value of $(x+1)f(x) - (x-1)f(x+1)$?

A. 0

B. 1

C. 2

D. 3

Answer: C

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14. If $f(x) = 3x^2 + 4x + 1$, then find $f(x) + f(-x)$.

A. 2

B. $6x^2$

C. $8x$

D. $2 + 6x^2$

Answer: D

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15. If $f(x) = \dfrac{x+1}{x-1}$, then find the value of $f(f(5))$.

A. 5

B. 3

C. 2

D. 0

Answer: A

16. If $f(x) = x^2 + 4x + 4$, then what is the value of $\dfrac{f(x + a) - f(x)}{(a + 2)^2}$?

A. 1

B. $(a + 2)$

C. $(a + 2)^2$

D. none of these

Answer: D

17. If $a + b + c = 0$ then the value of

$(a + b - c)^3 + (a - b + c)^3 + (-a + b + c)^3$ is

A. $3(a + b - c)(a - b + c)(-a + b + c)$

B. $(a + b - c)(a - b + c)(-a + b + c)$

C. 0

D. none of these

Answer: A

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18. $\{a(b - c)\}^3 + \{b(c - a)\}^3 + \{c(a - b)\}^3$ is equal to

A. $a^3 + b^3 + c^3$

B. $3(ab - ac)(bc - ba)(ca - bc)$

C. 0

D. none of these

Answer: B

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19. Which of the following is equivalent to $2b^2c^2 + 2c^2a^2 + 2a^2b^2 - a^4 - b^4 - c^4$?

A. $(a + b + c)(a - b + c)(a + b - c)(-a + b + c)$

B. $(a + b + c)(a - b + c)(a + b - c)$

C. $(a - b - c)(-a + b + c)(a + b - c)$

D. none of these

Answer: A

20. If $f(x) = 2x^2 - x + a + b$ such that $f(0) = 1$ and $f(1) = -2$, then the values of a and b are

A. $a = 0, b = 1$

B. $a = 4, b = -7$

C. $a = 2, b = -3$

D. No possible value

Answer: D

1. If $a^2 + b^2 + c^2 - ab - bc - ca = 0$, then

    A. $a + b + c = 0$

    B. $a = b = c$

    C. $a = b = -c$

    D. $a = -b = c$

Answer: B

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2. Factorize $a^2 - (b - c)^2$.

A. $(a + b - c)(a - b + c)$

B. $(a - b - c)(a - b + c)$

C. $(a - b + c)(a + b - c)$

D. $(a + b - c)(a - b + c)$

Answer: A

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3. The factorized form of $(x - 1)^2 + 20(x - 1) + 36$ is

A. $(x + 17)(x + 1)$

B. $(x - 17)(x + 1)$

C. $(x - 16)(x + 17)$

D. $(x + 17)(x - 1)$

Answer: A

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4. The factorized form of $x^5 + x^4 - x - 1$ is

A. $(x + 1)^2 (x + 1)^2 (x - 1)$

B. $(x^2 + 1)(x^2 + 1)^2 (x - 1)$

C. $(x^2 + 1)(x + 1)^2 (x - 1)$

D. $(x^2 + 1)^2 (x - 1)$

Answer: C

5. Factorize $x^6 + 27$.

A. $(x^2 + 3)(x^2 + 3x + 3)(x^2 - 3x + 3)$

B. $(x^2 - 3)(x^2 + 3x + 3)(x^2 + 3x + 3)$

C. $(x^2 + 3)(x^4 - 3x^2 + 9)^2$

D. $(x^2 + 3)(x^2 - 3x + 3)(x^2 - 3x - 3)$

Answer: C

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6. The simplified form of $\dfrac{a}{x+a} + \dfrac{b}{x-a} - \dfrac{c}{x^2 - a^2}$ is

A. $\dfrac{a(x-a) + b(x+a) - c}{x^2 - a^2}$

B. $\dfrac{b(x-a) + a(x+a) - c}{(x-a)^2}$

C. $\dfrac{b(x - a) + a(x + a) - c}{x^2 - a^2}$

D. $\dfrac{a(x - a) + b(x + a) + c}{x^2 - a^2}$

Answer: D

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7. Simplify

$$\dfrac{1}{(x + 1)(x + 2)} + \dfrac{1}{(x + 2)(x + 3)} + \dfrac{1}{(x + 3)(x + 1)}$$

A. $\dfrac{1}{(x + 1)(x + 3)}$

B. $\dfrac{2}{(x + 1)(x + 3)}$

C. $\dfrac{3}{(x + 2)(x + 3)}$

D. $\dfrac{3}{(x + 1)(x + 3)}$

Answer: D

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8. Factorize $4(a - b)^2 - 9(a + b)^2$.

    A. $(5a + b)(a + 5b)$

    B. $-(5a + b)(a + 5b)$

    C. $-(5a + b)(a + 5b)$

    D. $-(5a - b)(a - 5b)$

Answer: B

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9. The factorized form of $x^2 - x + \dfrac{1}{4}$ is

A. $\left(x - \dfrac{1}{2}\right)\left(x - \dfrac{1}{2}\right)$

B. $(2x - 2)\left(x - \dfrac{1}{2}\right)$

C. $(2x - 2)(2x - 2)$

D. $(x - 2)(x - 2)$

Answer: A

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10. The factorized form of $a^2 + ac + bc - b^2$ is

A. $(a - b)(a + b + c)$

B. $(a + b)(a - b - c)$

C. $(a + b)(a - b + c)$

D. $(a - b)(a - b - c)$

Answer: C

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Test Yourself Game Time Illustrated Puzzles

1. A student working in a fish biology laboratory finds that the head of a fish is 10 cm long and the tail is as long as its head plus half its body length. The body is as long as its head plus tail. What is the length of the fish?

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2. The manager of a game park wanted to check the number of deer and starks. He did this by counting the heads and legs. If

the number of legs counted is 130 and the heads 45, how many deer and starks were there?

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3. The sum of the ages of x, y and z is 90 years. Ten years ago, their ages were in the ratio $1 : 2 : 3$. What is the present age of y?

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