

# Getting Pass Tutorial for DSE

Name: \_\_\_\_\_

Class: \_\_\_\_\_

## Tutorial 1 Laws of Integral Indices

### Key Points

#### Laws of Integral Indices

If  $m, n$  are integers, and  $a, b \neq 0$ , then

1.  $a^m \cdot a^n = a^{m+n}$

2.  $\frac{a^m}{a^n} = a^{m-n}$

3.  $(a^m)^n = a^{mn}$

4.  $(ab)^n = a^n b^n$

5.  $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$

6.  $a^{-n} = \frac{1}{a^n}$

7.  $a^0 = 1$

### Revision Exercise

#### Short Questions

1. Simplify  $\frac{x^7}{x^4 y^{-5}}$  and express your answer with positive indices.

2. Simplify  $\frac{m^2 n^{-4}}{m^{-3}}$  and express your answer with positive indices.

3. Simplify  $\frac{a^{-3} b^{-2}}{b^6}$  and express your answer with positive indices.

4. Simplify  $\frac{x^{-14}y^9}{y^5}$  and express your answer with positive indices.
5. Simplify  $\frac{x^{-1}y^4}{x^3y}$  and express your answer with positive indices.
6. Simplify  $\frac{x^{-7}y^5}{x^2y^{-8}}$  and express your answer with positive indices.
7. Simplify  $\frac{(m^6n^{-5})^2}{n^9}$  and express your answer with positive indices.
8. Simplify  $\frac{m^{15}n^{18}}{(m^2n)^7}$  and express your answer with positive indices.
9. Simplify  $\frac{(ab)^3}{a^{-4}b^7}$  and express your answer with positive indices.

10. Simplify  $\frac{(a^2b^{-3})^4}{b^{-5}}$  and express your answer with positive indices.

11. Simplify  $\frac{a^{11}}{(a^4b^{-9})^4}$  and express your answer with positive indices.

12. Simplify  $x^7\left(\frac{x^2}{y}\right)^2$  and express your answer with positive indices.

13. Simplify  $m^5\left(\frac{m^4}{n^{-2}}\right)^5$  and express your answer with positive indices.

14. Simplify  $\frac{(a^3b)^{-1}}{(-ab^{-4})^{-2}}$  and express your answer with positive indices.

**Multiple Choice Questions**

1.  $(2x)^3 \cdot x^6 =$

A.  $2x^9$ .

B.  $6x^6$ .

C.  $8x^9$ .

D.  $12x^{18}$ .

2.  $(4n + 3n)n^4 =$

A.  $7n^5$ .

B.  $7n^6$ .

C.  $12n^5$ .

D.  $12n^8$ .

3.  $\frac{(5n^4)^3}{5n^3} =$

A.  $25n^4$ .

B.  $25n^9$ .

C.  $125n^{12}$ .

D.  $125n^{15}$ .

4.  $(3y^4)^{-4} =$

A.  $\frac{1}{12}$ .

B.  $\frac{1}{12y^8}$ .

C.  $\frac{1}{81y^{16}}$ .

D.  $\frac{1}{81y^{256}}$ .

5.  $\frac{(7m^5)^{-3}}{7m^6} =$

A.  $49m^9$ .

B.  $49m^{90}$ .

C.  $\frac{1}{2401m^{21}}$ .

D.  $\frac{1}{2401m^{90}}$ .

6.  $(64 \cdot 4^{n-2})^3 =$

A.  $2^{6n+6}$ .

B.  $2^{6n+12}$ .

C.  $2^{12n+18}$ .

D.  $2^{12n+24}$ .

# Getting Pass Tutorial for DSE

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
## Tutorial 2 Polynomials, Identities and Factorization

### Key Points


#### Polynomials

1. A polynomial can be a monomial or the sum of two or more monomials, e.g.  $-1, n, 4m^2, 2a - 3, -3x + 5z + 6xy^2$ .
2. The terms that contain the same variable(s) to the same power(s) are called like terms. Otherwise, they are called unlike terms.
3. Addition and subtraction of polynomials can be performed by combining like terms.
4. We can multiply polynomials by applying the distributive law of multiplication:
 

(a)  $a(x + y) = ax + ay$



(b)  $(x + y)a = xa + ya$



#### Identities

1. An equation that can be satisfied by ALL values of the unknown(s) is called an identity. We use the symbol ' $\equiv$ ' instead of '=' to represent an identity.
2. Some important algebraic identities
  - (a) Difference of two squares:  

$$a^2 - b^2 \equiv (a + b)(a - b)$$
  - (b) Perfect square:  

$$(a + b)^2 \equiv a^2 + 2ab + b^2$$

$$(a - b)^2 \equiv a^2 - 2ab + b^2$$

#### Factorization

1. The process of expressing an algebraic expression as a product of its factors is called factorization. It is the reverse process of expansion.
2. Methods of factorization
  - (a) By taking out common factors
  - (b) By grouping terms method
  - (c) By using identities (refer to 'Identities' above)
  - (d) By cross-method

e.g.  $x^2 - 2x - 3 \equiv (x + 1)(x - 3)$  ←

$x$	$+1$	$\swarrow$
$x$	$-3$	$\searrow$
$+x$	$-3x = -2x$	

**Revision Exercise****Short Questions**

1. Expand

(a)  $(x + 4)(3x - 2)$ ,

(b)  $(a + 5)(a^2 - 3a + 1)$ .

2. If  $m$  and  $n$  are constants such that  $x^2 + n \equiv (x - 1)(x + m) + 2$ , find the values of  $m$  and  $n$ .

3. If  $p$  and  $q$  are constants such that  $2x^2 - x + q - 5 \equiv (2x + 1)(x + p)$ , find the values of  $p$  and  $q$ .

**4. Factorize**

**(a)**  $2u - 6v$ ,

**(b)**  $u^2 - 6uv + 9v^2$ ,

**(c)**  $u^2 - 6uv + 9v^2 - 2u + 6v$ .

**5. Factorize**

**(a)**  $3m + 6n$ ,

**(b)**  $m^2 + 7mn + 10n^2$ ,

**(c)**  $m^2 + 7mn + 10n^2 + 3m + 6n$ .

**6. Factorize**

**(a)**  $x^2 - 8xy + 16y^2$ ,

**(b)**  $x^2 - 8xy + 16y^2 + 3x - 12y$ .

**7.** Factorize

**(a)**  $9m^2 - 4n^2$ ,

**(b)**  $9m^2 - 4n^2 + 12m + 8n$ .

**8.** Factorize

**(a)**  $6 + 2a - 3b - ab$ ,

**(b)**  $6 + 2a - 3b - ab + 12 - 6b$ .

**9.** Factorize

**(a)**  $a^2 + 8a - 9$ ,

**(b)**  $ab^2 + 9b^2 + a^2 + 8a - 9$ .



**10. Factorize**

(a)  $p^2 - 6pq + 8q^2$ ,

(b)  $p^2 - 6pq + 8q^2 - 2p + 8q$ .

**11. Factorize**

(a)  $2m^2 + 3mn - 5n^2$ ,

(b)  $2m^2 + 3mn - 5n^2 + (m - n)^2$ .

**12. Factorize**

(a)  $4x^2 + 20xy + 25y^2$ ,

(b)  $4x^2 + 20xy + 25y^2 - 100$ .

**13. Factorize**

(a)  $y^3 - 2xy^2 + 5y^2$ ,

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

**Multiple Choice Questions**

1.  $(x-2)(x^2+2x-4) =$

A.  $x^3 - 8$ .

B.  $x^3 - 8x + 8$ .

C.  $x^3 + 4x^2 - 8x + 8$ .

D.  $x^3 - 4x^2 - 8x + 8$ .

2.  $(3x+5y)^2 - (3x-5y)^2 =$

A. 0.

B.  $10y^2$ .

C.  $34xy$ .

D.  $60xy$ .

3. If  $p$  and  $q$  are constants such that  $x^2 + p \equiv (x-4)(x+q) - 8$ , then  $p =$

A. -24.

B. -8.

C. 4.

D. 24.

4. If  $p$  and  $q$  are constants such that  $x^2 - px + q \equiv (x-2)(x+p) + 5$ , then  $q =$

A. -1.

B. 1.

C. 3.

D. 7.

5. If  $a$  and  $b$  are constants such that  $ax(x+5) + x^2 \equiv bx(x-3) - x$ , then  $b =$

A.  $-\frac{3}{2}$ .

B.  $-\frac{1}{2}$ .

C.  $\frac{1}{2}$ .

D.  $\frac{3}{2}$ .

6. If  $h$  and  $k$  are constants such that  $h(x+5)^2 + k(x-2)^2 \equiv 2x^2 - 22x - 13$ , then  $h =$

A.  $-3$ .

B.  $-1$ .

C.  $1$ .

D.  $3$ .

7.  $49 - (x - 4y)^2 =$

A.  $(7 - x + 4y)(7 + x + 4y)$ .

B.  $(7 - x + 4y)(7 + x - 4y)$ .

C.  $(7 - x - 4y)(7 + x + 4y)$ .

D.  $(7 - x - 4y)(7 + x - 4y)$ .

8.  $ux - vx - uy + vy - uz + vz =$

A.  $(u+v)(x-y+z)$ .

B.  $(u+v)(x+y-z)$ .

C.  $(u-v)(x+y+z)$ .

D.  $(u-v)(x-y-z)$ .

9.  $7p + 7q - p^2 + q^2 =$

A.  $(p+q)(7+p-q)$ .

B.  $(p+q)(7-p+q)$ .

C.  $(p-q)(7+p-q)$ .

D.  $(p-q)(7-p+q)$ .

10.  $x^2 - 4y^2 - 12y - 9 =$

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

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

C.  $(x+2y-3)(x+2y+3)$ .

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

# Getting Pass Tutorial for DSE

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## Tutorial 3 Algebraic Fractions and Formulas

### Key Points

#### Algebraic Fractions

##### 1. Multiplication and division

$$\text{e.g. } \frac{x^2}{y^6} \times \frac{y^4}{x^3} = \frac{\cancel{x^2}}{\cancel{y^6}} \times \frac{\cancel{y^4}}{\cancel{x^3}} = \frac{1}{xy^2} \quad \text{and}$$

$$\frac{a^3}{2b^4} \div \frac{a^2}{4b} = \frac{a^3}{2b^4} \times \frac{4b}{a^2} = \frac{\cancel{a^3}^1}{\cancel{2b^4}^2} \times \frac{\cancel{4}^2}{\cancel{a^2}} = \frac{2a}{b^3}$$

##### 2. Addition and subtraction

$$\text{e.g. } \frac{3}{x} + \frac{1}{2x} = \frac{6}{2x} + \frac{1}{2x} = \frac{7}{2x} \quad \text{and}$$

$$\frac{1}{m} - \frac{1}{m+1} = \frac{(m+1) - m}{m(m+1)} = \frac{1}{m(m+1)}$$

#### Formulas and Method of Substitution

A formula is an equality relating two or more variables. By substitution, we can find the value of a variable in a formula when the values of other variables are known. For example, consider the formula  $A = lw$ . If  $l = 7$  and  $w = 2$ , then

$$\begin{aligned} A &= 7 \times 2 \\ &= \underline{\underline{14}} \end{aligned}$$

#### Subject of a Formula

If a variable is expressed in terms of other variables, it is called the subject of the formula.

##### Example

Make  $p$  the subject of the formula  $q = 4p + 9$ .

*Solution*

$$\begin{aligned} q &= 4p + 9 \\ q - 9 &= 4p \\ p &= \frac{q - 9}{4} \end{aligned}$$

**Revision Exercise****Short Questions****1. Simplify**

**(a)**  $\frac{3x^4}{y^6} \times \frac{y^5}{6x^2},$

**(b)**  $\frac{2m}{n^3} \div \frac{m^7}{8n^4}.$

**2. Simplify**

**(a)**  $\frac{1}{m} + \frac{3}{4m},$

**(b)**  $\frac{3}{2p} - \frac{1}{6p}.$

**3. Simplify**

**(a)**  $\frac{2a}{a+1} + \frac{2}{1+a},$

**(b)**  $\frac{b}{1-2b} - \frac{1}{2b-1}.$

**4. Simplify**

(a)  $\frac{1}{b} + \frac{2}{b-1}$ ,

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

**5. Simplify**

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

(b)  $\frac{2}{m+4} - \frac{3}{5m-2}$ .

**6.** Make  $h$  the subject of the formula  $\frac{9h-7k}{2} = -4$ .

7. Make  $x$  the subject of the formula  $\frac{6x + 7y - 9}{y} = 3$ .

8. Make  $w$  the subject of  $4w - 6 = 5(v - w)$ .

9. Make  $c$  the subject of  $\frac{6d - 7c}{5} = c - 1$ .

10. Make  $n$  the subject of the formula  $n(m - 5) = 3m + 2n$ .

11. Make  $r$  the subject of the formula  $Hr = (6r - K)S$ .

12. Make  $q$  the subject of the formula  $\frac{2-p}{3-q} = 4p$ .

13. Make  $a$  the subject of the formula  $\frac{ca+b}{a-b} = 2$ .

14. Make  $t$  the subject of the formula  $\frac{6t-s}{3-t} = 2s$ .



**15.** Make  $t$  the subject of the formula  $\frac{4}{s} + \frac{5}{t} = 3$ .

**16.** Make  $b$  the subject of the formula  $\frac{1}{3a} - \frac{1}{6b} = \frac{2}{3}$ .

**17.** Consider the formula  $\frac{4}{2-a} = \frac{5}{3b+1}$ .

- (a) Make  $b$  the subject of the above formula.  
(b) If  $a = -6$ , find the value of  $b$ .

**18.** It is given that  $6p - 1 = \frac{9p - q}{5 - r}$ .

- (a) Express  $p$  in terms of  $q$  and  $r$ .  
(b) If  $q = 1$  and  $r = -2$ , find the value of  $p$ .

**19.** Consider the formula  $2(5e - f) = e + 8$ .

- (a) Make  $f$  the subject of the above formula.  
(b) If the value of  $e$  is increased by 4, write down the change in the value of  $f$ .

**20.** Consider the formula  $6(4 + 3v - 4w) = 20v$ .

- (a) Make  $v$  the subject of the above formula.  
(b) If the value of  $w$  is decreased by 2, write down the change in the value of  $v$ .

**Multiple Choice Questions**

1.  $\frac{3}{3-2r} + \frac{2r}{2r-3} =$

A.  $-1.$

B.  $1.$

C.  $\frac{3+2r}{3-2r}.$

D.  $\frac{3+2r}{2r-3}.$

2.  $\frac{2}{2s+5} - \frac{1}{3-s} =$

A.  $-\frac{11}{(2s+5)(s-3)}.$

B.  $\frac{11}{(2s+5)(s-3)}.$

C.  $\frac{1-4s}{(2s+5)(s-3)}.$

D.  $\frac{4s-1}{(2s+5)(s-3)}.$

3. If  $6c = 3 - 5d$ , then  $d =$

A.  $\frac{3(1-2c)}{5}.$

B.  $\frac{3(1+2c)}{5}.$

C.  $\frac{3(2c-1)}{5}.$

D.  $\frac{5(2c-1)}{3}.$

4. If  $A = \frac{LT}{B} + 5$ , then  $T =$

A.  $\frac{(5-A)L}{B}.$

B.  $\frac{(5-A)B}{L}.$

C.  $\frac{(A-5)L}{B}.$

D.  $\frac{(A-5)B}{L}.$

5. If  $4p - 5 = 2(q - 4)$ , then  $q =$

A.  $2p - 9.$

B.  $2p - 1.$

C.  $2p - \frac{13}{2}.$

D.  $2p + \frac{3}{2}.$

6. If  $p = \frac{5s}{3t-2s}$ , then  $s =$

A.  $\frac{3pt}{2p-5}.$

B.  $\frac{3pt}{2p+5}.$

C.  $pt.$

D.  $7pt.$

7. If  $x = \frac{y+2}{y-7}$ , then  $y =$

A.  $y = \frac{-5}{x-1}$ .

B.  $y = \frac{9}{x+1}$ .

C.  $y = \frac{7x+2}{x-1}$ .

D.  $y = \frac{7x+2}{x+1}$ .

8. If  $p = \frac{3}{2-q} + 7$ , then  $q =$

A.  $q = \frac{17-2p}{p-7}$ .

B.  $q = \frac{2p-17}{p-7}$ .

C.  $q = \frac{2p+17}{p-7}$ .

D.  $q = \frac{2p+17}{p+7}$ .

9. If  $\frac{c}{w} - \frac{d}{v} = 5$ , then  $w =$

A.  $\frac{cv}{d-5v}$ .

B.  $\frac{cv}{d+5v}$ .

C.  $\frac{dv}{c-5v}$ .

D.  $\frac{dv}{c+5v}$ .

10. If  $\frac{x+2}{h} = \frac{x-2}{k}$ , then  $x =$

A.  $\frac{h+k}{2(h-k)}$ .

B.  $\frac{h+k}{2(k-h)}$ .

C.  $\frac{2(h+k)}{h-k}$ .

D.  $\frac{2(h+k)}{k-h}$ .

11. If  $\frac{3-c}{c} = \frac{3+x}{x}$ , then  $x =$

A.  $\frac{2c}{2-3c}$ .

B.  $\frac{2c}{2+3c}$ .

C.  $\frac{3c}{3-2c}$ .

D.  $\frac{3c}{3+2c}$ .

# Getting Pass Tutorial for DSE

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## Tutorial 4 Percentages

### Key Points

#### Percentage

$$\text{Percentage} = \frac{\text{part}}{\text{whole}} \times 100\%$$

If  $P$  is  $a\%$  more than  $Q$ , then  $P = Q(1 + a\%)$

If  $R$  is  $b\%$  less than  $S$ , then  $R = S(1 - b\%)$

$$\text{Percentage increase} = \frac{\text{new value} - \text{original value}}{\text{original value}} \times 100\% \quad (\text{if new value} > \text{original value})$$

$$\text{Percentage decrease} = \frac{\text{original value} - \text{new value}}{\text{original value}} \times 100\% \quad (\text{if new value} < \text{original value})$$

$$\text{Percentage change} = \frac{\text{new value} - \text{original value}}{\text{original value}} \times 100\%$$

#### Profit and Loss

$$\text{Profit} = \text{selling price} - \text{cost price}$$

$$\text{Profit per cent} = \frac{\text{profit}}{\text{cost price}} \times 100\%$$

$$\text{Selling price} = \text{cost price} \times (1 + \text{profit per cent})$$

$$\text{Loss} = \text{cost price} - \text{selling price}$$

$$\text{Loss per cent} = \frac{\text{loss}}{\text{cost price}} \times 100\%$$

$$\text{Selling price} = \text{cost price} \times (1 - \text{loss per cent})$$

#### Discount

$$\text{Discount} = \text{marked price} - \text{selling price}$$

$$\text{Discount per cent} = \frac{\text{discount}}{\text{marked price}} \times 100\%$$

$$\text{Selling price} = \text{marked price} \times (1 - \text{discount \%})$$

**Revision Exercise****Short Questions**

1. A pet shop sells cats and dogs only. There are 16 cats in the pet shop and the number of dogs is 50% more than that of cats.
  - (a) Find the number of dogs in the pet shop.
  - (b) What is the percentage of dogs in the pet shop?
  
2. There are 250 girls in a ceremony and the number of boys is 40% less than that of girls.
  - (a) Find the number of boys in the ceremony.
  - (b) What is the percentage of boys in the ceremony?
  
3. There are 800 local visitors in a museum and the number of non-local visitors is 75% less than that of local visitors.
  - (a) Find the number of non-local visitors in the museum.
  - (b) What is the percentage of local visitors in the museum?

4. Andy is 10% shorter than Sam, and Sam is 10% taller than Ben. The height of Andy is 168.3 cm.
- (a) Find the height of Sam.
  - (b) Is Ben taller than Andy? Explain your answer.
5. The top speed of car *A* is 25% lower than that of car *B*, while the top speed of car *B* is 25% higher than that of car *C*. It is given that the top speed of car *B* is 120 km/h.
- (a) Find the top speed of car *A*.
  - (b) Which car has the lowest top speed? Explain your answer.
6. The marked price of a cup is \$40. It is given that the marked price of the cup is 25% higher than the cost.
- (a) Find the cost of the cup.
  - (b) If the cup is sold at \$42, find the profit per cent.

7. The marked price of a jacket is \$250. The jacket is sold at a discount of 40% on its marked price.
- (a) Find the selling price of the jacket.
  - (b) A loss of \$10 is made by selling the jacket. Find the loss per cent.
8. The marked price of a cupboard is \$845. It is given that the marked price of the cupboard is 30% higher than its cost.
- (a) Find the cost of the cupboard.
  - (b) If the cupboard is sold at \$637, find the loss per cent.
9. The marked price of a book is \$270. The book is sold at a discount of 30% on its marked price.
- (a) Find the selling price of the book.
  - (b) If the marked price of the book is 35% above its cost, determine whether there will be a gain or a loss on selling the book. Explain your answer.



**10.** The marked price of a wallet is \$550. The wallet is sold at a discount of 32% on the marked price.

- (a) Find the selling price of the wallet.
- (b) If the profit per cent is 49.6%, find the cost of the wallet.

**11.** The marked price of a watch is \$420. The watch is sold at a discount of 15% on its marked price.

- (a) Find the selling price of the watch.
- (b) If the loss percent is 10.75%, find the cost of the watch.

**12.** The cost of a bicycle is \$600. The bicycle is sold and the profit per cent is 32%.

- (a) Find the selling price of the bicycle.
- (b) If the bicycle is sold at a discount of 20%, find the marked price of the bicycle.

- 13.** The cost of a necklace is \$300. The necklace is sold at a discount of 30% and the profit per cent is 5%. Find the marked price of the necklace.
- 14.** The cost of a chair is \$240. If the chair is sold at a discount of 20% on its marked price, then the loss per cent is 15%. Find the marked price of the chair.
- 15.** There are 320 male workers in a factory and the number of female workers is 30% more than that of male workers.
- (a) Find the number of female workers in the factory.
  - (b) There are 92 part-time workers in the factory.
    - (i) Find the percentage of part-time workers in the factory.
    - (ii) It is given that 12.5% of the male workers are part-time workers. If  $x\%$  of the female workers are also part-time workers, find the value of  $x$ .

