A-Level Starter Activity

Jethwa Maths

Topic: Simple Index Laws

Chapter Reference: Pure 1, Chapter 1

8 minutes

1. Write down the value of $32^{\frac{1}{5}}$ **(1)**

2. Calculate $16^{\frac{3}{4}}$ **(2)**

3. Evaluate 3^{-2} **(1)**

4. Simplify fully $(32x^5)^{-\frac{2}{5}}$ **(3)**

5. Simplify fully $\frac{(2x^{\frac{1}{2}})^3}{4x^2}$ **(3)**

6. Work out $\frac{3^{-5}}{3^{-4}} \times \frac{2^2}{2^{-1}}$ **(2)**

Solutions

1.

$32^{\frac{1}{5}} = \sqrt[5]{32} = 2$	**M1**

2.

$16^{\frac{3}{4}} = (\sqrt[4]{16})^3$	**M1**
$= 2^3 = 8$	**M1**

3.

$3^{-2} = \frac{1}{3^2} = \frac{1}{9}$	**M1**

4.

$(32x^5)^{-\frac{2}{5}} = 32^{-\frac{2}{5}} x^{-2}$	**M1**
$= \frac{1}{32^{\frac{2}{5}}} \times \frac{1}{x^2}$ $= \frac{1}{(\sqrt[5]{32})^2} \times \frac{1}{x^2}$	**M1**
$= \frac{1}{4x^2}$	**M1**

5.

$\frac{(2x^{\frac{1}{2}})^3}{4x^2} = \frac{2^3(x^{\frac{1}{2}})^3}{4x^2}$	**M1**
$= \frac{8x^{\frac{3}{2}}}{4x^2}$	**M1**
$= 2x^{-\frac{1}{2}}$	**M1**

6.

$\frac{3^{-5}}{3^{-4}} \times \frac{2^2}{2^{-1}} = 3^1 \times 2^3$	**M1**
$= 3 \times 8 = 24$	**M1**

A-Level Starter Activity

Jothwa Maths

Topic: Simple Index Laws

Chapter Reference: Pure 1, Chapter 1

8 minutes

1. Find the value of $125^{-\frac{2}{3}}$ **(2)**

2. Find the value of $(\frac{8}{27})^{\frac{2}{3}}$ **(2)**

3. Simplify the expression $\frac{abc^2 \times a^3c}{ab^2 \times (c^2)^3}$ **(2)**

4. Write $9^5 \times 3^{-5}$ as a power of 3 **(2)**

5. Given that $32\sqrt{2} = 2^a$, find the value of a **(2)**

Solutions

1.

$125^{-\frac{2}{3}} = \frac{1}{125^{\frac{2}{3}}} = \frac{1}{(\sqrt[3]{125})^2}$	**M1**
$= \frac{1}{25}$	**M1**

2.

$(\frac{8}{27})^{\frac{2}{3}} = \frac{8^{\frac{2}{3}}}{27^{\frac{2}{3}}} = \frac{(\sqrt[3]{8})^2}{(\sqrt[3]{27})^2}$	**M1**
$= \frac{4}{9}$	**M1**

3.

$\frac{abc^2 \times a^3c}{ab^2 \times (c^2)^3} = \frac{a^4bc^3}{ab^2c^6}$	**M1**
$= a^3b^{-1}c^{-3}$ or $\frac{a^3}{bc^3}$	**M1**

4.

$9^5 \times 3^{-5} = (3^3)^5 \times 3^{-5} = 3^{15} \times 3^{-5}$	**M1**
$= 3^{10}$	**M1**

5.

$32\sqrt{2} = 2^5 \times 2^{\frac{1}{2}}$	**M1**
$= 2^{\frac{11}{2}}$ Where a is $\frac{11}{2}$	**M1**

A-Level Starter Activity

Jethwa Maths

Topic: Simple Index Laws

Chapter Reference: Pure 1, Chapter 1

8 minutes

1. Express 8^{2x+3} in the form 2^y stating y in terms of x **(3)**

3. Evaluate $\frac{\sqrt{200}}{\sqrt{8}}$ **(2)**

3. Express $7^4 \times 49^{10}$ in the form 7^k **(2)**

4. Simplify $x(2x^{-\frac{1}{4}})^4$ **(2)**

5. Simplify fully: $(\frac{64x^6}{25y^2})^{-\frac{1}{2}}$ **(3)**

Solutions

1.

$8^{2x+3} = 8^{2x} \times 8^3$	**M1**
$= (2^3)^{2x} \times (2^3)^3$ $= 2^{6x} \times 2^9$	**M1**
$= 2^{6x+9}$ Where $y = 6x + 9$	**M1**

2.

$\frac{\sqrt{200}}{\sqrt{8}} = \frac{\sqrt{100} \times \sqrt{2}}{\sqrt{4} \times \sqrt{2}}$	**M1**
$= \frac{10}{2} = 5$	**M1**

3.

$7^4 \times 49^{10} = 7^4 \times (7^2)^{10} = 7^4 \times 7^{20}$	**M1**
$= 7^{24}$ When $k = 24$	**M1**

4.

$x(2x^{-\frac{1}{4}})^4 = x \times 2^4 \times (x^{-\frac{1}{4}})^4 = x \times 16 \times x^{-1}$	**M1**
$= 16$	**M1**

5.

$(\frac{64x^6}{25y^2})^{-\frac{1}{2}} = \frac{(64x^6)^{-\frac{1}{2}}}{(25y^2)^{-\frac{1}{2}}} = \frac{64^{-\frac{1}{2}}(x^6)^{-\frac{1}{2}}}{25^{-\frac{1}{2}}(y^2)^{-\frac{1}{2}}}$	**M1**
$= \frac{\frac{1}{8}x^{-3}}{\frac{1}{5}y^{-1}} = \frac{5y}{8x^3}$	**M1**

A-Level Starter Activity

Jotnwa Maths

Topic: Factorising

Chapter Reference: Pure 1, Chapter 1

6 minutes

1. Factorise completely $x - 4x^3$ **(1)**

2. Factorise fully $4xy^5 + y^5 + 12y^7$ **(1)**

3. Fully factorise $3x^3 - 4x^2 - 35x + 12$ **(2)**

4. $g(x) = 6x^3 - 7x^2 - 71x + 12$. Find the value of x when $g(x) = 0$. **(4)**

5. $f(x) = x^3 + 2x^2 - 11x - 12$

a. Evaluate f(1), f(2), f(-1) and f(-2) **(2)**

b. State the linear factors of $f(x)$ and fully factorise $f(x)$. **(2)**

Solutions

1.

$x - 4x^3 = x(1 - 4x^2) = x(1 - 2x)(1 + 2x)$	**M1**

2.

$4xy^5 + y^5 + 12y^7 = y^5(4x + 1 + 12y^2)$	**M1**

3.

Use of calculator to give, $x_1 = 4$ $x_2 = \frac{1}{3}$ $x_3 = -3$	**M1**
$(x - 4)(3x - 1)(x + 3)$	**M1**

4.

Use of calculator to give, $x_1 = 4$ $x_2 = \frac{1}{6}$ $x_3 = -3$	**M1**
$(x - 4)(6x - 1)(x + 3)$	**M1**

5a.

$f(1) = 1^3 + 2(1)^2 - 11(1) - 12 = -20$ $f(2) = 2^3 + 2(2)^2 - 11(2) - 12 = -18$	**M1**
$f(-1) = (-1)^3 + 2(-1)^2 - 11(-1) - 12 = 0$ $f(-2) = (-2)^3 + 2(-2)^2 - 11(-2) - 12 = 10$	**M1**

5b.

Use of calculator: $x_1 = -1$ $x_2 = 3$ $x_3 = -4$	**M1**
$(x + 1)(x - 3)(x + 4)$	**M1**

A-Level Starter Activity

Jotnwa Maths

Topic: Simplifying Surds

Chapter Reference: Pure 1, Chapter

8 minutes

1. Express each of the following in the form $a\sqrt{5}$, where a is an integer,

i. $4\sqrt{15} \times \sqrt{3}$ **(2)**

ii. $\frac{20}{\sqrt{5}}$ **(2)**

iii. $5^{\frac{3}{2}}$ **(2)**

2. Express $(5 - \sqrt{8})(1 + \sqrt{2})$ in the form $a + b\sqrt{2}$, where a and b are integers. **(3)**

3. Simplify $\frac{7+\sqrt{5}}{\sqrt{5}-1}$, giving your answer in the form $a + b\sqrt{5}$, where a and b are integers. **(3)**

Solutions

1i.

$4\sqrt{15} \times \sqrt{3} = 4\sqrt{45} = 4 \times \sqrt{5} \times \sqrt{9}$	**M1**
$= 12\sqrt{5}$	**M1**

1ii.

$\frac{20}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{20\sqrt{5}}{5}$	**M1**
$= 4\sqrt{5}$	**M1**

1ii.

$5^{\frac{3}{2}} = (\sqrt{5})^3 = \sqrt{5} \times \sqrt{5} \times \sqrt{5}$	**M1**
$= 5\sqrt{5}$	**M1**

2.

$(5 - \sqrt{8})(1 + \sqrt{2}) = 5 - \sqrt{16} + 5\sqrt{2} - \sqrt{8}$	**M1**
$= 1 + 5\sqrt{2} - 2\sqrt{2}$	**M1**
$= 1 + 3\sqrt{2}$	**M1**

3.

$\frac{7+\sqrt{5}}{\sqrt{5}-1} \times \frac{\sqrt{5}+1}{\sqrt{5}+1}$	**M1**
$= \frac{7\sqrt{5} + 7 + 5 + \sqrt{5}}{5 - 1}$ $= \frac{12 + 8\sqrt{5}}{4}$	**M1**
$= 3 + 2\sqrt{5}$	**M1**

A-Level Starter Activity

Jethwa Maths

Topic: Complex Surds

Chapter Reference: Pure 1, Chapter 1

8 minutes

1. Show that $\frac{4}{3}\sqrt{\frac{300}{4}}+\frac{10}{\sqrt{3}}$ can be written as $k\sqrt{a}$, where k and a are integers. **(4)**

2. Show that $(\frac{4}{3})^{\frac{1}{2}}+(\frac{1}{3})^{-\frac{1}{2}}$ can be written as $\frac{a}{b}\sqrt{c}$, where a, b and c are all integers. **(3)**

3. Show that $(4+3\sqrt{x})^2$ can be written as $16+k\sqrt{x}+9x$, where k is a constant to be found. **(2)**

Solutions

1.

$\frac{4}{3}\sqrt{\frac{300}{4}} = \frac{4}{3} \times \frac{\sqrt{300}}{\sqrt{4}} = \frac{4}{3} \times \frac{10\sqrt{3}}{2} = \frac{4}{3} \times 5\sqrt{3} = \frac{20\sqrt{3}}{3}$	**M1 M1**
$\frac{10}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{10\sqrt{3}}{3}$	**M1**
$\frac{20\sqrt{3}}{3} + \frac{10\sqrt{3}}{3} = \frac{30\sqrt{3}}{3} = 10\sqrt{3}$	**M1**

2.

$(\frac{4}{3})^{\frac{1}{2}} = \frac{\sqrt{4}}{\sqrt{3}} = \frac{2}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{3}$	**M1**
$(\frac{1}{3})^{-\frac{1}{2}} = 3^{\frac{1}{2}} = \sqrt{3}$	**M1**
$(\frac{4}{3})^{\frac{1}{2}} + (\frac{1}{3})^{-\frac{1}{2}} = \frac{2\sqrt{3}}{3} + \sqrt{3} = \frac{5}{3}\sqrt{3}$	**M1**

3.

$(4 + 3\sqrt{x})\,(4 + 3\sqrt{x}) = 16 + 9x + 12\sqrt{x} + 12\sqrt{x}$	**M1**
$16 + 24\sqrt{x} + 9x$	**M1**

A-Level Starter Activity

Jethwa Maths

Topic: Rationalising Surds

Chapter Reference: Pure 1, Chapter 1

8 minutes

1. Express $\sqrt{80} + \frac{30}{\sqrt{5}}$ **(3)**

2. Express $\frac{1+\sqrt{5}}{2+\frac{5}{\sqrt{5}}}$ **(3)**

3a. Write $\sqrt{80}$ in the form $c\sqrt{5}$, where c is a positive constant. **(1)**

A rectangle has a length of $(1 + \sqrt{5})$cm and an area of $\sqrt{80}$ cm^2.

b. Calculate the width of R in cm. Express in the form $p + q\sqrt{5}$, where p and q are integers to be found. **(4)**

Solutions

1.

$\sqrt{80} = \sqrt{16 \times 5} = 4\sqrt{5}$	**M1**
$\frac{30}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{30\sqrt{5}}{5} = 6\sqrt{5}$	**M1**
$\sqrt{80} + \frac{30}{\sqrt{5}} = 4\sqrt{5} + 6\sqrt{5} = 10\sqrt{5}$	**M1**

2.

$2 + \frac{5}{\sqrt{5}} = 2 + (\frac{5}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}) = 2 + \frac{5\sqrt{5}}{5} = 2 + \sqrt{5}$	**M1**
$\frac{1+\sqrt{5}}{2+\frac{5}{\sqrt{5}}} = \frac{1+\sqrt{5}}{2+\sqrt{5}} \text{ x } \frac{2-\sqrt{5}}{2-\sqrt{5}}$	**M1**
$= \frac{2-5-\sqrt{5}+2\sqrt{5}}{4-5-2\sqrt{5}+2\sqrt{5}} = \frac{-3+\sqrt{5}}{-1} = 3 - \sqrt{5}$	**M1**

3a.

$\sqrt{80} = \sqrt{16 \times 5} = 4\sqrt{5}$	**M1**

3b.

Width = $\frac{\sqrt{80}}{1+\sqrt{5}}$	**M1**
$\frac{\sqrt{80}}{1+\sqrt{5}} \times \frac{1-\sqrt{5}}{1-\sqrt{5}} = \frac{4\sqrt{5}-20}{1-\sqrt{5}+\sqrt{5}-5}$	**M1**
$= \frac{4\sqrt{5}-20}{-4}$	**M1**
$= 5-\sqrt{5}$	**M1**