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= Year 12 **= Algebra of functions** **= Worksheet 4**

1. Find *a*, *b*, *c* and *d* such that $P(x)=12x^3-4x^2-17x-6=a(x+b)(x+c)(x+d)$.

2. Refer to $P(x)$ in Q1. Find *a*, *b*, *c* and *d* such that $P\left(x-\frac{1}{2}\right)=a(x+b)(x+c)(x+d)$.

3. Find the equation of the relation formed after the relation $(x+2)^2+(y-4)^2=4$ undergoes the following transformations in the order as shown. Reflection in the y-axis, 4 units down, 2 units left, vertical dilation by factor $\frac{1}{2}$, horizontal dilation by factor $\frac{1}{2}$.

4. Refer to Q3. Now carry out the transformations in reverse order. Find the equation of the relation formed.

5. Find the coordinates of the intersection of $y=1+\sqrt{x+1}$ and $y=2\sqrt{x}$.

6. The two functions in Q5 undergo the same transformations as in Q3. Find the coordinates of the intersection of the transformed functions.

7. If $x+\frac{1}{x}=2$, find the value of (i) $x^2+\frac{1}{x^2}$, (ii) $\sqrt{x}+\frac{1}{\sqrt{x}}$.

8. Given $\log_y x-\log_x y=\frac{8}{3}$, find the positive value of $\frac{\log_e x}{\log_e y}$.

9. Use the result in Q8 to solve $\log_y x-\log_x y=\frac{8}{3}$ and $x-16y=0$ simultaneously.

10. Given $3f(x)+f\left(\frac{1}{x}\right)=\frac{2}{x}$, show that $f(-x)=-f(x)$.

Numerical, algebraic and worded answers. 2. $a=12$, $b=-2$, $c=\frac{1}{6}$, $d=0$ or any permutation of *b*, *c* and *d*. 5. $\left(\frac{16}{9},\frac{8}{3}\right)$ 8. 3
6. $\left(-\frac{17}{9},-\frac{2}{3}\right)$ 1. $a=12$, $b=-\frac{3}{2}$, $c=\frac{2}{3}$, $d=\frac{1}{2}$ or any permutation of *b*, *c* and *d*. 3. $x^2+y^2=1$. 9. $x=64$, $y=4$.
7(i) 2 (ii) 2. 4. $(x+3)^2+(y+2)^2=1$.