

# Functions II

*Please simplify your answers wherever possible.*

**Question 1** Let  $f(x) = x^6$ ,  $g(x) = \frac{x}{1-x}$ , and  $h(x) = x^3 - 5x^2 + 1$ . Calculate the following functions:

- a.  $f(g(x))$
- b.  $h(f(t))$
- c.  $h(g(x))$
- d.  $g(f(x))$
- e.  $g(h(t))$
- f.  $f(h(x))$

**Question 2** Sketch the following functions:

- a.  $f(x) = 3 - x$
- b.  $g(x) = |x - 2|$
- c.  $h(x) = x^3 + 5$
- d.  $y = |x^2 - 5| + 3$
- e.  $y = 2^x - 5$
- f.  $y = \sqrt{x}$  for  $x \geq 0$

**Question 3** Factor the following polynomials:

- a.  $x^2 + 7x + 12$
- b.  $x^2 - 13x + 12$
- c.  $x^2 - 4x - 12$
- d.  $x^2 + 4x - 12$
- e.  $x^2 - 6x + 9$
- f.  $x^2 - 25$
- g.  $3x^2 - 21x + 30$
- h.  $20 + 8x - x^2$
- i.  $x^2 - 8x$

j.  $x^3 + 3x^2 - 18x$

k.  $x^3 - 10x$

**Question 4** Solve the following equations for x (factoring the function if possible):

a.  $x^2 - 2x - 15 = 0$

b.  $x^2 - 20 = 0$

c.  $x^2 + 10x + 25 = 0$

d.  $5x^2 - 4x - 1 = 0$

e.  $x^2 - 4x - 5 = 0$

f.  $15x^2 - 135x + 300 = 0$

g.  $z^2 - \sqrt{2}z - \frac{5}{4} = 0$

h.  $\frac{3}{2}x^2 - 6x + 5 = 0$

i.  $9x^2 - 12x + 4 = 0$

**Question 5** Find the points of intersection of the following pairs of curves:

a.  $y = 2x^2 - 5x - 6, y = 3x + 4$

b.  $y = x^2 - 10x + 9, y = x - 9$

c.  $y = x^2 - 4x + 4, y = 12 + 2x - x^2$

d.  $y = 3x^2 + 9, y = 2x^2 - 5x + 3$

e.  $\frac{1}{2}x^3 - 2x^2, y = 2x$

f.  $\frac{1}{2}x^3 + x^2 + 5, y = 3x^2 - \frac{1}{2}x + 5$

**Question 6** Compute/simplify the following using the laws of exponents:

a.  $5^{1/3} \cdot 200^{1/3}$

b.  $6^{1/3} \cdot 6^{2/3}$

c.  $(9^{4/5})^{5/8}$

d.  $(125 \cdot 27)^{1/3}$

e.  $\frac{7^{4/3}}{7^{1/3}}$

f.  $\sqrt{1+x}(1+x)^{3/2}$

g.  $(16x^8)^{-3/4}$

**h.**  $\frac{(25xy)^{3/2}}{x^2y}$

**Question 7** Write the following in the form  $e^{kx}$  for a suitable constant k:

**a.**  $(\frac{1}{e^3})^{2x}$

**b.**  $e^{1-x}e^{3x-1}$

**c.**  $(e^{4x}e^{6x})^{3/5}$

**d.**  $\frac{1}{\sqrt{e^{-x}e^{7x}}}$

**Question 8** Solve the following for x:

**a.**  $2^x5^x = 10^3$

**b.**  $\sqrt{(2^3)^x} = 64$

**c.**  $9^{x-5} = 27$

**d.**  $\frac{5^x4^x}{2^3} = 100$

**e.**  $e^5x = e^{20}$

**f.**  $e^{x^2-2x} = e^8$

**g.**  $e^x(x^2 - 1) = 0$

**h.**  $4e^x(x^2 + 1) = 0$

**i.**  $\ln(4 - x) = \frac{1}{2}$

**j.**  $\ln(3x) = 2$

**k.**  $\ln x^2 = 9$

**l.**  $\ln(x^2 - 5) = 0$

**m.**  $\ln(\ln(3x)) = 0$

**n.**  $\log_2(5) + \log_2(x) = \log_2(10)$

**o.**  $5 \log_3(2x) - 2 \log_3(1) = 8$

**p.**  $(e^2)^x e^{\ln 1} = 4$

**q.**  $e^{\ln x + \ln 2} = 4$

**r.**  $\ln \sqrt{x} = \sqrt{\ln x}$

**s.**  $2(\ln x)^2 + \ln x - 1 = 0$

**t.**  $\ln[(x-3)(x+2)] - \ln(x+2)^2 - \ln 7 = 0$

**Question 9** Plot the following functions:

**a.**  $y = e^{-x}$

**b.**  $y = -e^x$

**c.**  $y = 100e^x$

**d.**  $y = 3^{2x}$

**e.**  $y = -\ln x$

**f.**  $y = \ln -x$

**g.**  $y = \ln(1^{-10^{10}}) + \ln(e^{-\frac{1}{x}})$

**h.**  $y = e^{\ln(x^2 - 6x + 9)}$

**i.**  $y = \ln x + 5$

**j.**  $y = 2^{x-3}$