TRANSFORMATIONS OF GRAPHS

Question 1

Describe geometrically each of the following transformations.

a) $f(x)+2$

b) $f(x+2)$

c) $2f(x)$

d) $f(2x)$

e) $-f(x)$

f) $f(x)-4$

g) $f(x-3)$

h) $3f(x)$

i) $f(-x)$

j) $f\left(\frac{1}{4}x\right)$

Question 2

Describe geometrically each of the following transformations.

a) $f\left(x+1\right)-2$

b) $4f\left(x-1\right)$

c) $3f\left(x\right)-1$

d) $f\left(2x+3\right)$

e) $4-f\left(x\right)$

f) $f\left(-3x\right)$

g) $-f\left(\frac{1}{2}x\right)$

h) $2\left[f\left(x\right)+3\right]$

i) $-4f\left(x\right)$

j) $f\left(2-x\right)$

Question 3

Describe geometrically each of the following transformations.

a) $2f\left(x-1\right)$

b) $f\left(3x+1\right)$

c) $f\left(4-x\right)$

d) $\frac{1}{2}f\left(\frac{1}{2}x+1\right)$

e) $f\left(\frac{1}{2}x-2\right)$

f) $f\left(5-x\right)$

g) $f\left(4-2x\right)$

h) $-4f\left(x\right)$

i) $f\left(2-x\right)$

Question 4

Write each of the transformations described below in f notation.

a) Translation "upwards" by 5 units

b) Translation "to the left" by 4 units

c) Stretch in the y direction by a factor of 3

d) Stretch in the x direction by a factor of $\frac{1}{2}$

e) Reflection about the x axis

f) Translation "downwards" by 1 unit

g) Translation "to the right" by 5 units

h) Stretch in the y direction by a factor of 4

i) Reflection about the y axis

j) Stretch in the x direction by a factor of 3

Question 5

Write each of the transformations described below in f notation.

a) Translation "to the left" by 2 units, followed by translation "downwards" by 4 units

b) Translation "to the right" by 3 units, followed by stretch in the y direction by a factor of 2

c) Stretch in the y direction by a factor of 6, followed by translation "downwards" by 5 units

d) Translation "to the left" by 5 units, followed by stretch in the x direction by a factor of $\frac{1}{2}$

e) Reflection about the x axis, followed by translation "upwards" by 2 units

f) Reflection about the y axis, followed by stretch in the x direction by a factor of 3

g) Reflection about the x axis, followed by stretch in the x direction by a factor of 2

h) Translation "upwards" by 1 unit, followed by stretch in the y direction by a factor of 3

i) Reflection about the x axis, followed by stretch in the y direction by a factor of 3

j) Translation "to the left" by 4 units, followed by reflection about the y axis

Question 6

Describe the transformation or set of transformations for each of the following mappings.

a) $\ln x \mapsto 2\ln(x-3)$

b) $\sin x \mapsto \sin\left(2x+\frac{\pi}{6}\right)$

c) $\sqrt{x} \mapsto \sqrt{3x-6}$

d) $\mathrm{e}^{x} \mapsto 4\mathrm{e}^{3x}-1$

e) $\frac{1}{x} \mapsto \frac{1}{2-x}$

f) $\ln\left(x^2+1\right) \mapsto \ln\left(4x^2+1\right)$

g) $\frac{1}{x^2+1} \mapsto \frac{4}{x^2+4}$ (hint: it is a single stretch)

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