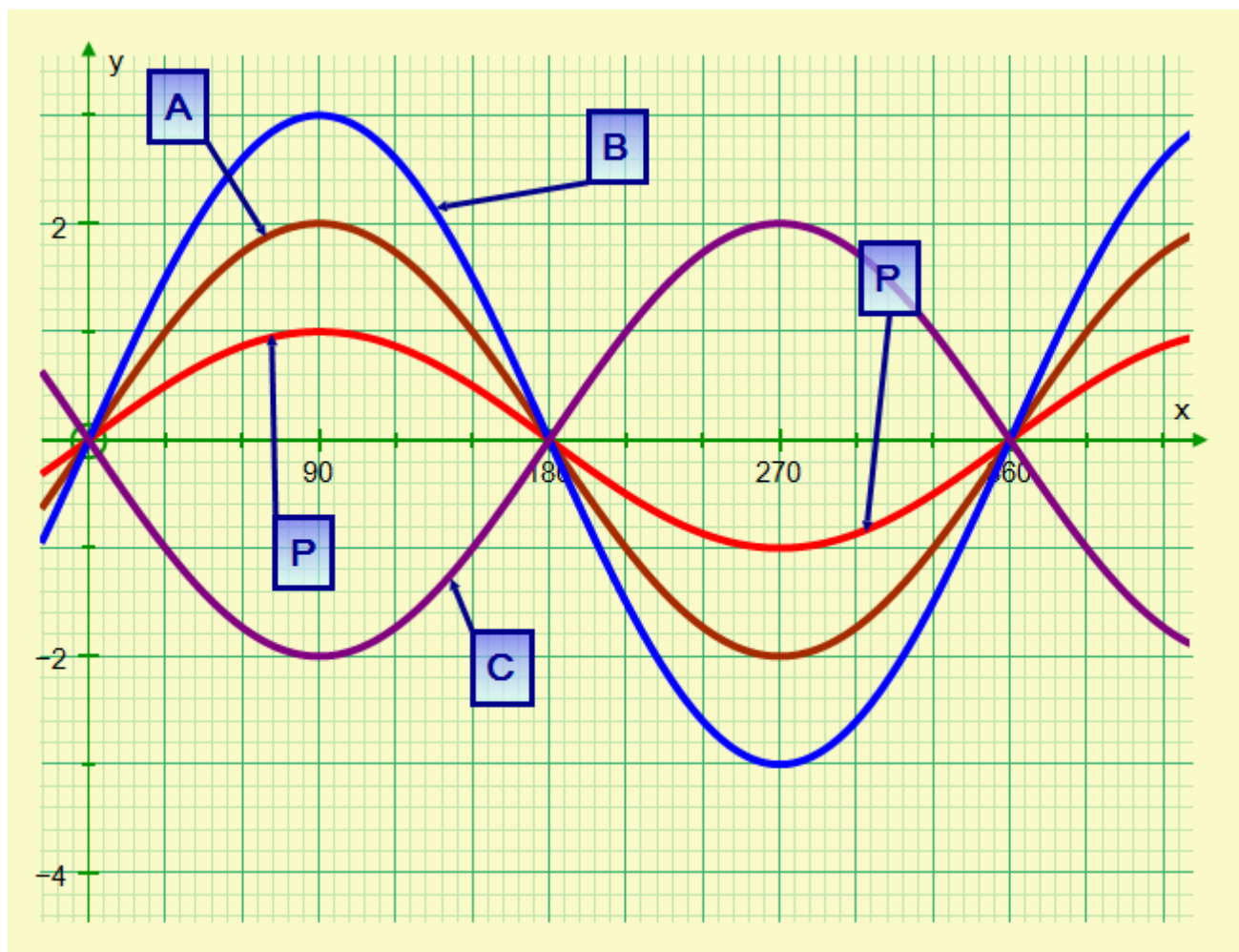


## Transformations of the Sine and Cosine Functions KS4 Higher + KS5

1. Graph, P, below is the graph of  $y = f(x) = \sin x$ .
  - (i) Describe the transformation that maps graph P onto:
    - (a) Graph A
    - (b) Graph B
    - \*(c) Graph C “\* = challenging”
  - (ii) Write down the equation of each of the graphs A and B, in terms of  $f(x)$  and  $\sin x$ .

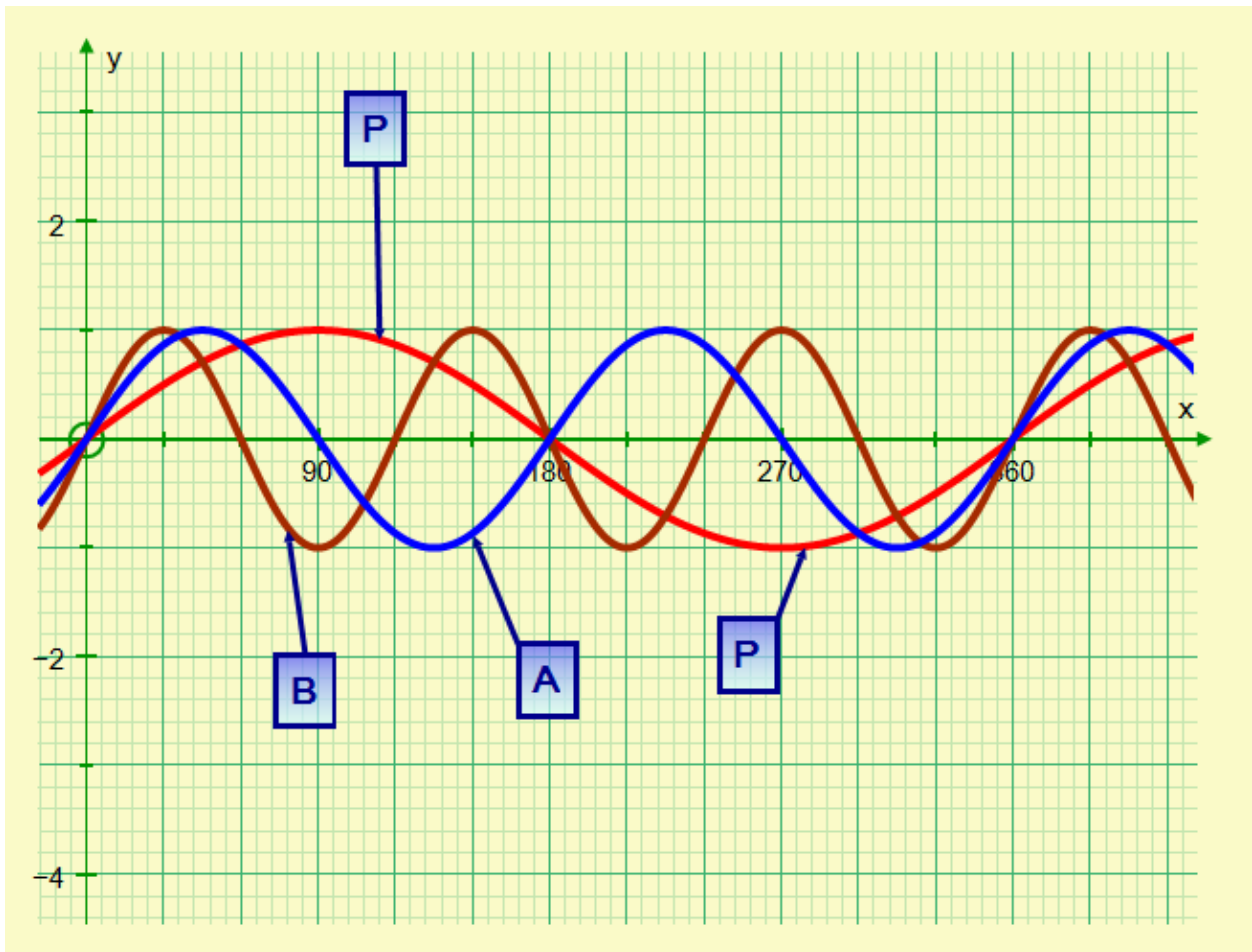


2. Graph, P, below is the graph of  $y = f(x) = \sin x$ .

(i) Describe the transformation that maps graph P onto:

(b) Graph A (b) Graph B

(ii) Write down the equation of each of the graphs A and B, in terms of  $f(x)$  and  $\sin x$ .

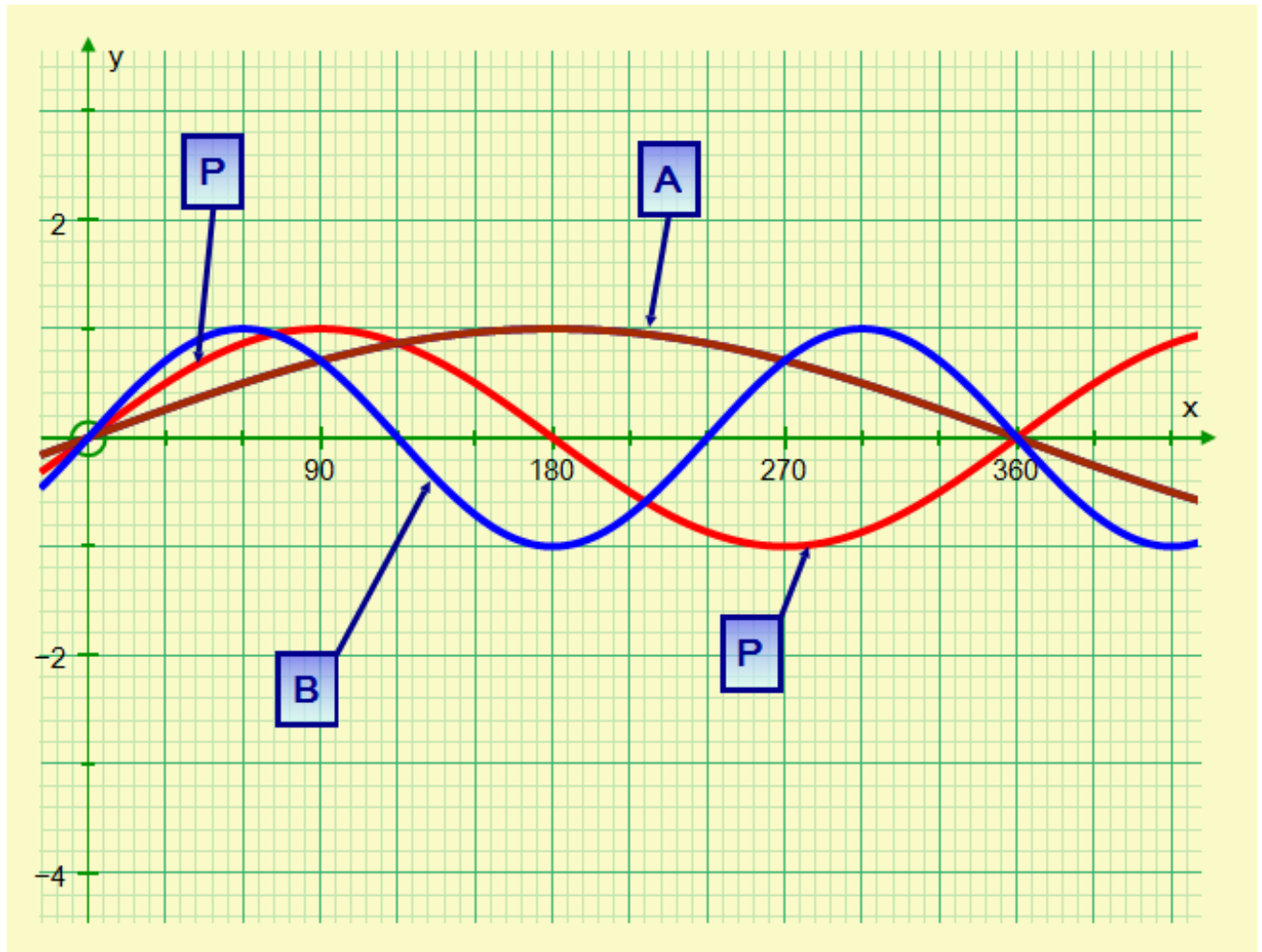


3. The graph P shows the graph of  $y = f(x) = \sin x$ .

(i) Describe the transformation that maps graph P onto:

(c) A      \*(b) B      “\* = challenging”

(ii) Write down the equation of each of the graphs A and B, in terms of  $f(x)$  and  $\sin x$ .

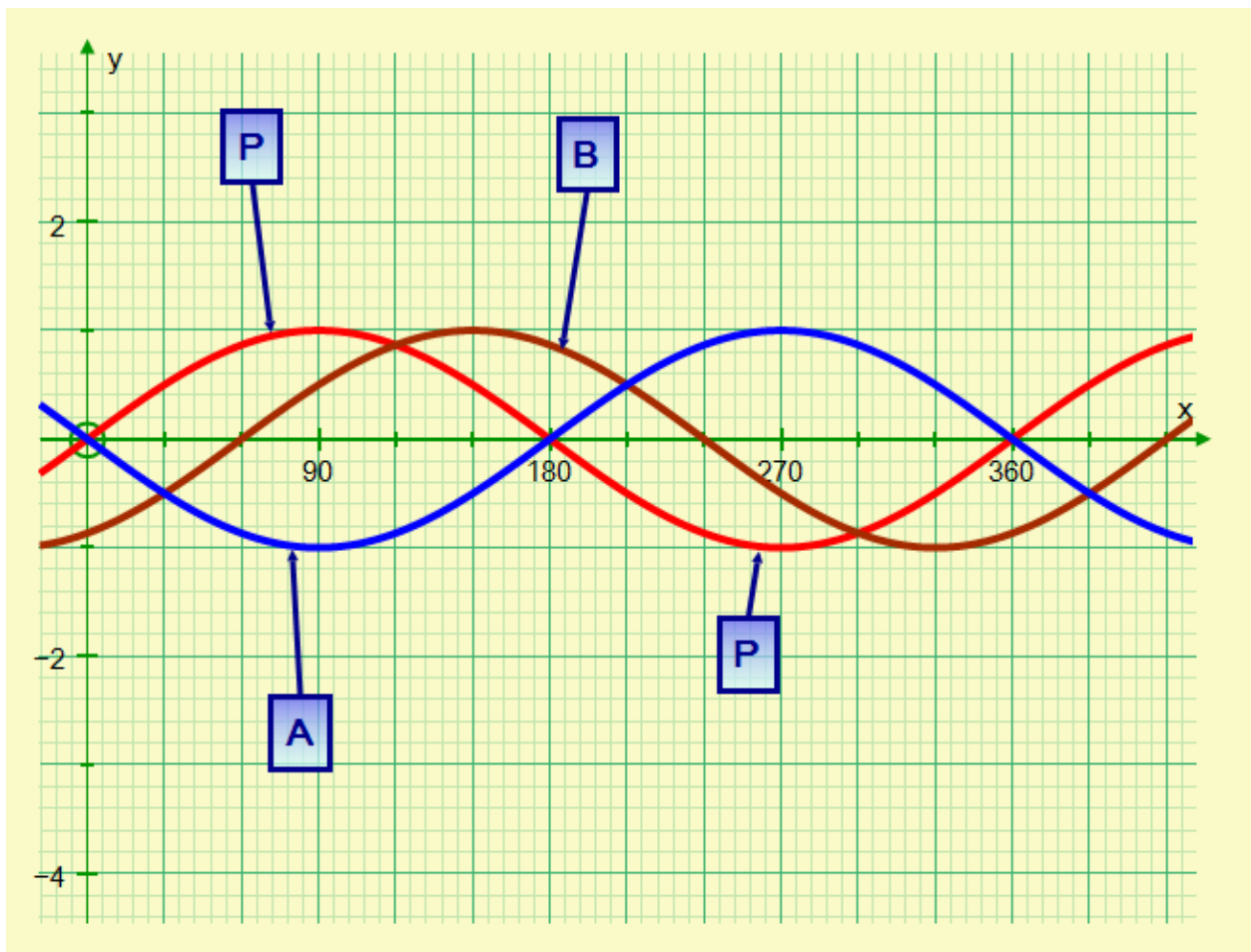


4. The graph P shows the graph of  $y = f(x) = \sin x$ .

(i) Describe the transformation that maps graph P onto:

(a) A      (b) B

(ii) Write down the equation of each of the graphs A and B, in terms of  $f(x)$  and  $\sin x$ .

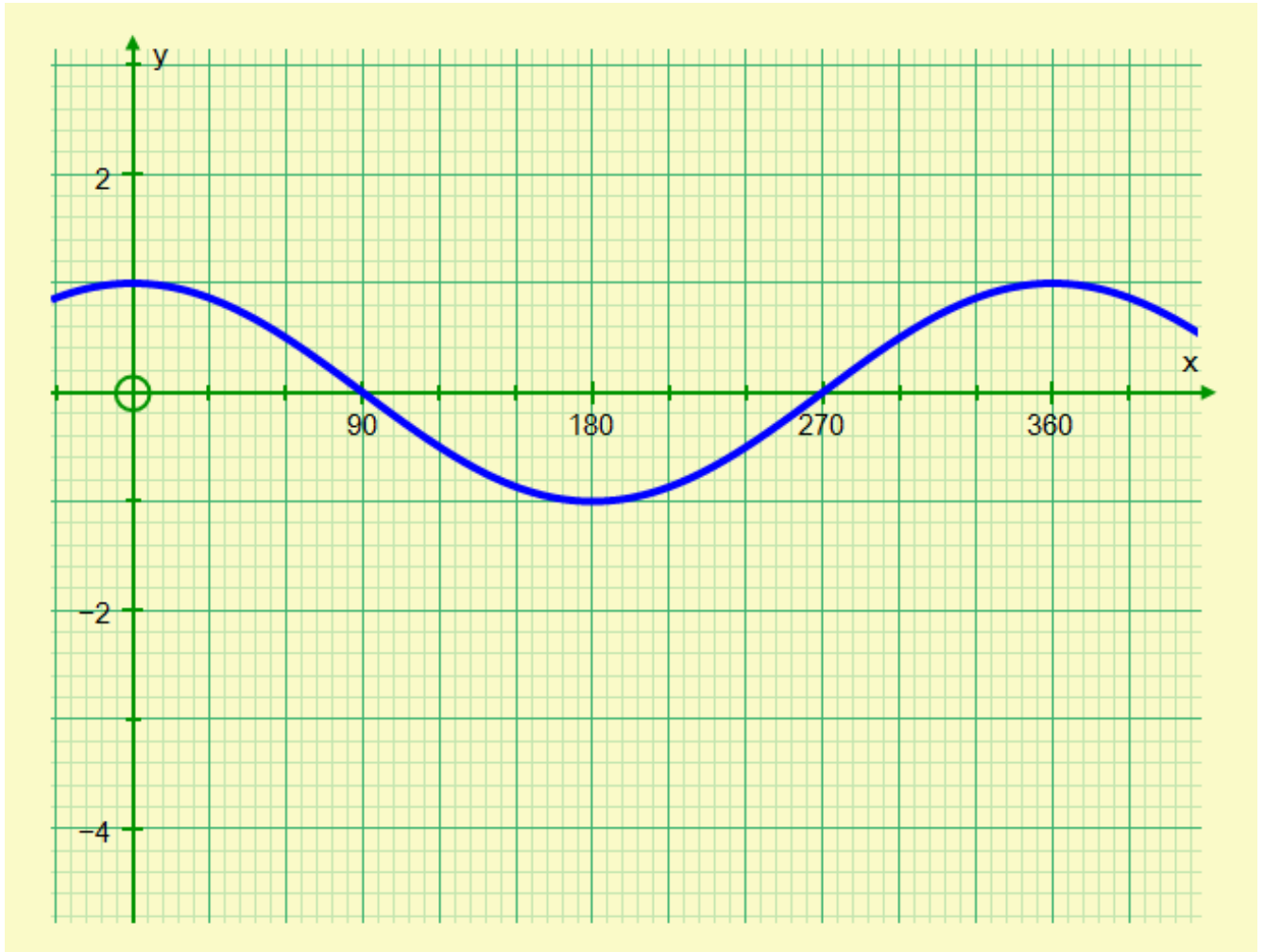


5. The diagram below shows the graph of  $y = f(x) = \cos x$  for  $0 \leq x \leq 360^\circ$ .

On the same diagram, draw the sketch of each of the following, for  $0 \leq x \leq 360^\circ$ :

(a)  $y = 2f(x)$    (b)  $y = -3f(x)$    (c)  $y = f(2x)$    (d)  $y = f(x - 30^\circ)$    \* (e)  $y = f\left(\frac{3}{2}x\right)$

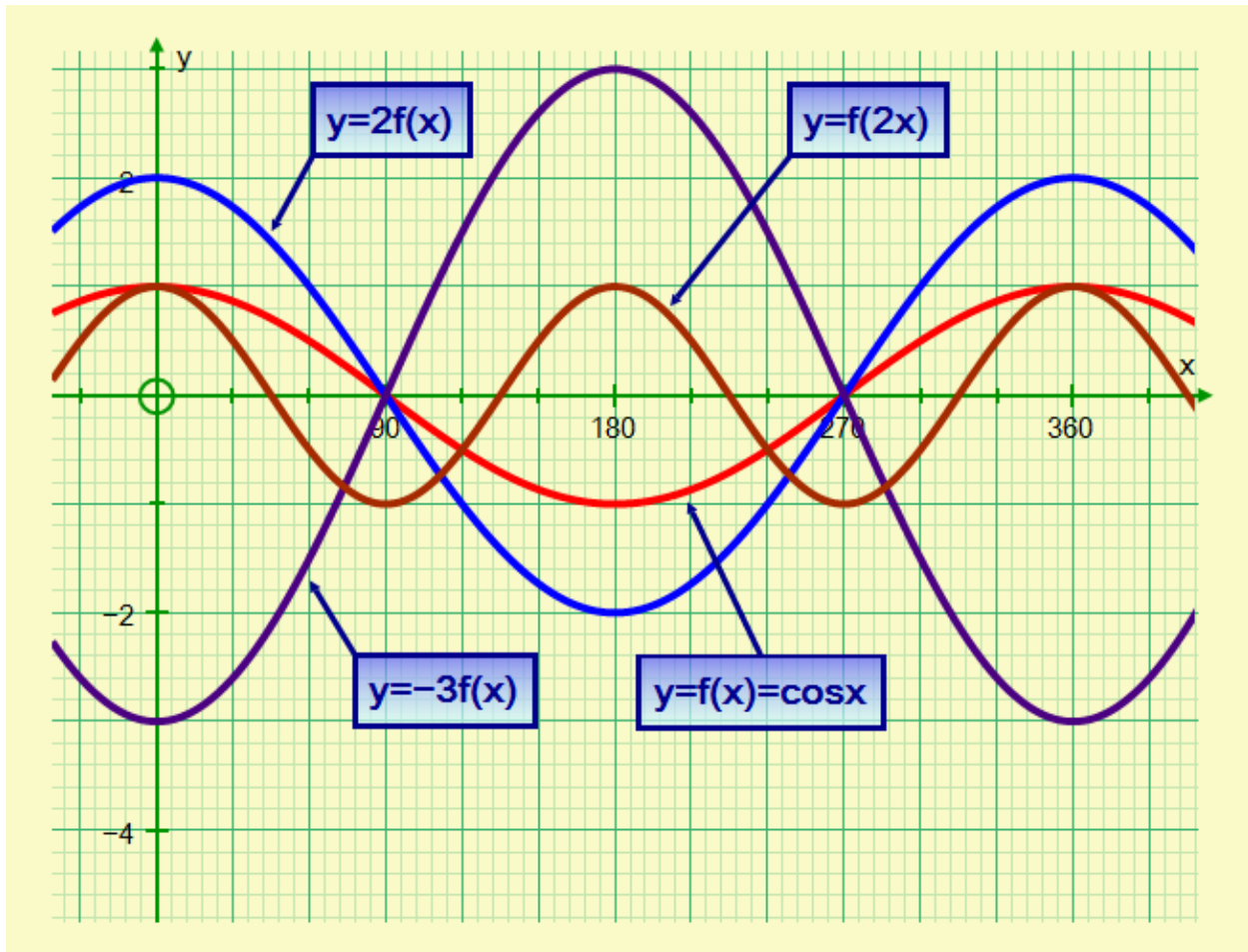
Label each graph clearly.



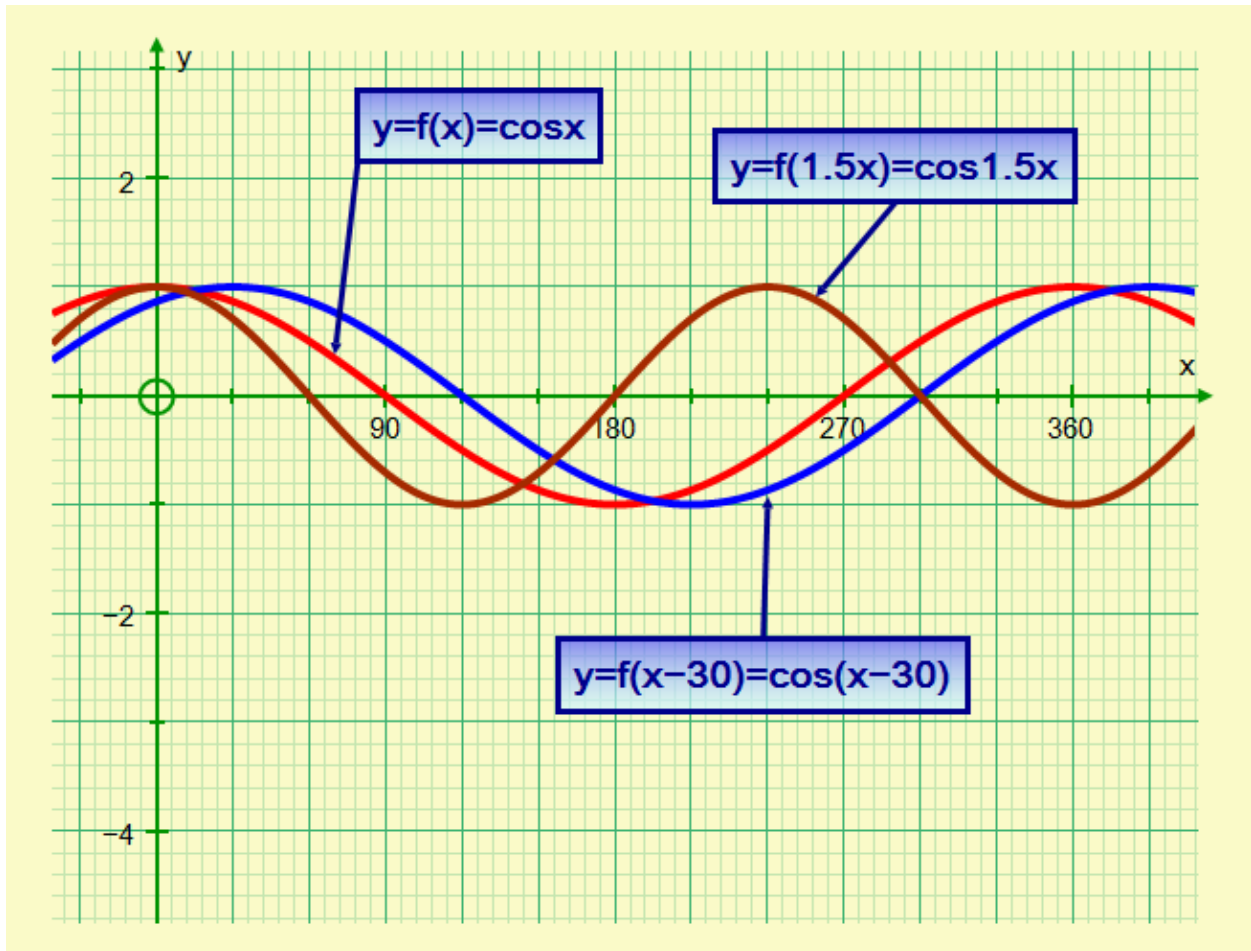
**Answers:**

1. (i) (a) Stretch scale factor (s.f), 2 parallel to the  $y$ -axis
  - (b) Stretch s.f, 3 parallel to the  $y$ -axis
  - (c) Reflection in the  $x$ -axis followed by a stretch scale factor (s.f), 2 parallel to the  $y$ -axis or the Stretch first, followed by the reflection.
- (ii) A:  $y = 2f(x) = 2\sin x$   
B:  $y = 3f(x) = 3\sin x$
  
2. (i) (a) Stretch scale factor (s.f),  $\frac{1}{2}$  parallel to the  $x$ -axis
  - (b) Stretch s.f,  $\frac{1}{3}$  parallel to the  $x$ -axis
- (ii) A:  $y = f(2x) = \sin 2x$   
B:  $y = f(3x) = \sin 3x$
  
3. (i) (a) Stretch scale factor (s.f), 2 parallel to the  $x$ -axis
  - (b) Stretch s.f,  $\frac{2}{3}$  parallel to the  $x$ -axis
- (ii) A:  $y = f\left(\frac{1}{2}x\right) = \sin\frac{1}{2}x$   
B:  $y = f\left(\frac{3}{2}x\right) = \sin\left(\frac{3}{2}x\right)$
  
4. (i) (a) Reflection in the  $x$ -axis
  - (b) Translation vector  $\begin{pmatrix} 60 \\ 0 \end{pmatrix}$
- (ii) A:  $y = -f(x) = -\sin x$   
B:  $y = f(x - 60^\circ) = \sin(x - 60^\circ)$
  
5. Refer to the diagrams below.

5. (a), (b) and (c)



5. (d) and (e)



The next worksheet will consider the following:

$y = f(x) \pm a$ ,  $y = \pm af(x) \pm b$ , and some examination style questions.

I hope you find this worksheet useful. If you find any errors, please let me know. Thank you.