**SUBSTITUTION TYPES.**

1. a) 

***Let u = x2 – 1***

b)  =

***Let u = x2 + 1***

c)  ***dx*** =

***Let u = x2 + 3***

d) **∫** ***3x2 (x3 + 4)7 dx***

e) **∫** ***x2( x3 – 2)4 dx***

f) ∫ ***x dx***

***x + 1***

g) **∫** ***x + 3 dx***

***x – 2***

2. Find these integrals:

(a) **∫** ***x + 1 dx***

***x – 1***

(b) **∫ *x dx***

***x2 – 1***

(c) **∫ *x2 dx***

***(x3 + 2)2***

(d) **∫**  ***sin 3x sin x dx***

**ANSWERS**

1. a) 

***Let u = x2 – 1***

***du = 2x dx***

I = **∫ u3 du**

***= u4 + c = (x2 – 1 )3 + c***

***4 4***

b)  =

***Let u = x2 + 1***

***du = 2x dx***

I = **∫ *u-2 du***

***= u – 1  + c***

***– 1***

***= – (x2 + 1) – 1  + c***

c)  ***dx*** =

***Let u = x2 + 3***

***du =2xdx***

***du = xdx***

***2***

**∫ *du***

***2u***

***= ½ ln(u) + c = ½ ln(x2 + 3) + c***

d) **∫** ***3x2 (x3 + 4)7 dx***

***u = x3 + 4***

***du = 3x2dx***

**∫ *u7du = u8 + c***

8

***= (x3 + 4)8 + c***

***8***

e) **∫** ***x2( x3 – 2)4 dx***

***u = x3 + 4***

***du = 3x2dx***

***du = x2dx***

***3***

I = **∫ *u4du = u5 + c***

***3 5×3***

***= (x3 – 2)5 + c***

***15***

f) ∫ ***x dx***

***x + 1*** ***u = x + 1***

***du = dx***

***x = u – 1***

***I =* ∫ *u – 1 du***

***u***

***=* ∫  *1 – 1 du = u – ln(u) + c***

***u***

***= x + 1 – ln(x + 1) + c***

g) **∫** ***x + 3 dx u = x – 2***

***x – 2 x = u + 2***

***x + 3 = u + 5***

***dx = du***

***I =* ∫  *u + 5 du =* ∫  *1 + 5 du***

***u u***

***= u + 5ln(u) + c***

***= x – 2 + 5ln(x – 2) + c***

**ANSWERS**

2. Find these integrals:

(a) **∫** ***x + 1 dx u = x – 1***

***x – 1 du = dx***

= **∫ *u + 2 du***

***u***

= **∫ *1 + 2 du***

***u***

***= u + 2 log u + c***

***= x – 1 + 2 log(x – 1) + c***

(b) **∫  *x dx***

***x2 – 1 u = x2 – 1***

***du = 2x dx***

***du = x dx***

***2***

***= ½* ∫  *du***

***u***

= ***½ log u + c***

***= ½ log ( x2 – 1) + c***

(c) **∫ *x2 dx***

***(x3 + 2)2***

***u = x3 + 2***

***du = 3x2 dx***

***du = x2 dx***

***3***

***= ⅓* ∫ *u – 2 du***

***= – ⅓ u – 1  + c***

***= – 1 + c***

***3(x3 + 2)***

(d) **∫**  ***sin 3x sin x dx***

***= – ½* ∫  *cos 4x – cos 2x dx***

***= – ½ ( sin 4x – sin 2x )***

***4 2***

***= – sin 4x + sin 2x + c***

***8 4***