**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***